

**For all Student Manual Guides being printed and CD/DVDs created:**

SM Printed Guides	SM CD/DVD (to be included in flap of each SM)
<p>Cover Page – Student Manual</p> <p>Tab 1: Unit 1 ICSSCI-U01sm FINAL.docx</p> <p>Tab 2: Unit 2 ICSSCI-U02sm FINAL.docx</p> <p>Tab 3: Unit 3 ICSSCI-U03sm FINAL.docx</p> <p>Tab 4: Unit 4 ICSSCI-U04sm FINAL.docx</p> <p>Tab 5: Unit 5 ICSSCI-U05sm FINAL.docx</p> <p>Tab 6: Unit 6 ICSSCI-U06sm FINAL.docx</p> <p>Appendix Tab:  Appendices Master Listing.docx  Equip List Four Ops Capabilities.docx  Glossary.docx  Structural Collapse Operational Chklst.docx  Structural Collapse Scene Assessment Chklst.docx  Structure-Hazards Marking System.docx</p> <p>Handouts to be printed for as many students as needed-left  separate from SM and given to the Instructor:  2005-09-05 hurricane katrina iap.pdf  2005-09-08 hurricane katrina iap.pdf</p>	<p>Directory – Student Manual  Cover Page – Student Manual.docx  ICSSCI-U01sm FINAL.docx  ICSSCI-U02sm FINAL.docx  ICSSCI-U03sm FINAL.docx  ICSSCI-U04sm FINAL.docx  ICSSCI-U05sm FINAL.docx  ICSSCI-U06sm FINAL.docx</p> <p>Directory - Appendix  Appendices Master Listing.docx  Equip List Four Ops Capabilities.docx  Glossary.docx  Pentagon After Action Report.pdf  OK City Murrah Building After Action Report.pdf  Structural Collapse Operational Chklst.docx  Structural Collapse Scene Assessment Chklst.docx  Structure-Hazards Marking System.docx  Temporary Shoring at Pentagon.pdf  Directory FDNY 911 reports  All files in directory  Directory FEMA ICS Forms  All files in directory</p> <p>Directory - Videos  Gordon Graham Risk Management.wmv  FEMA-Intro Final.wmv  Initial Response Video Final.wmv  Metro Dade Video Full Length Final.wmv</p>

# ***UNIT 1: INTRODUCTION***

## ***TERMINAL OBJECTIVE***

*The students will be able to describe key aspects of a structural collapse.*

## ***ENABLING OBJECTIVES***

*The students will:*

- 1. Identify hazards and conditions associated with a structural collapse.*
  - 2. Understand the causes and complexities of structural collapses.*
  - 3. Describe the difference between response and recovery operations.*
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## **COURSE OVERVIEW**

### **Course Goal**

The goal of this course is to provide fire officers with an understanding of Command operations at structural collapse incidents.

### **Why Do I Need a Course on Structural Collapse?**

As fire officers, it is important for you to gain a basic knowledge of factors involved in incidents of this type. It is possible for all of us to be involved in such an incident during our careers. This course should leave you with an appreciation for incident complexity and with the knowledge that successful conclusion of incidents of this type depends on strong Command skills and effective incident management.

### **Instructional Units**

During the next 2 days, we will cover the following instructional units:

- Unit 1: Introduction.
- Unit 2: The Incident Command System Organizational Structure.
- Unit 3: Response Resource Capabilities.
- Unit 4: Scene Management: Factors and Issues.
- Unit 5: Response Functions.
- Unit 6: Structural Collapse: Operational Phases.

## **OVERVIEW OF STRUCTURAL COLLAPSE**

### **Causes and Complexities of Structural Collapse**

Structures collapse from a variety of causes. Over 500 major collapses occur in the United States each year. Collapses can occur due to a manmade or a natural event, which can include the following.



### Construction Accidents

These may result from design problems, overloading, or poor construction. They may occur during construction or after construction has been completed, when the structure is occupied or in use.

### Structural Deterioration

As structures age, structural weaknesses develop from building material failure, settling, or other factors. A minor causative event may result in collapse.

### Fire or Explosion

Fire commonly causes structural collapse by destroying building materials and weakening support elements. Explosions cause rapid collapse due to blast forces on the structure. Explosions can be caused by natural events or acts of terrorism.

### Natural Hazards (e.g., Earthquakes, Hurricanes, Tornadoes, Floods, and Landslides)

Structures react differently to stresses caused by earth movement, water, or wind forces, thus creating different rescue problems and strategies. These events may cause widespread damage, with multiple-site rescues and large numbers of victims.

### Transportation Accidents

Vehicles, trains, ships, and aircraft may crash into structures. When structures collapse in these incidents, the complexity of the response increases.

## **Specific Causes and Factors**

### Natural Disasters

Earthquakes, hurricanes, tornadoes, floods, mudslides, high winds, snow, heavy rainfall, tsunamis, ocean waves, ground subsidence, and landslides may result in major damage to structures, numerous victims and hazards, and damage to the infrastructure over a large geographic area.

### Wall Failure

Supporting walls can collapse from foundation failure, deterioration, and vertical and horizontal stresses. These collapses most commonly create lean-to void spaces.

### Overloaded Floors

The most common causes of failure from heavy loading are heavy machinery and equipment. Additional loads tremendously stress the beams, and even a slight impact load applied to the floor may cause beam failure. Victims may be found in V-shaped or lean-to void spaces, or pinned under stock and debris.

### Overloaded Roofs

Possible causes of collapse include excessive weight, such as air-handling units, large signs, heavy snow or rain, and improper or blocked drainage ducts. Roof failure may cause partial or entire roof pancake collapse and wall collapse.

### Column or Arch Failure

If a column supporting a beam joint fails or an arch fails, collapse will occur, sometimes with little warning. These collapses generally create V-shaped void spaces.

### Structural Weakness

This problem is one of the most difficult to detect because the majority of the structural elements vital to a building's stability may be hidden from view by interior or exterior coverings, such as plaster and siding materials. Exposure to weather, shaking from earthquakes or constant vibration, and neglect cause structures to deteriorate rapidly. Collapses in already-weakened structures may result in a variety of conditions and voids.

### Improper Alterations

This is a common cause of structural collapse in the urban environment. These alterations may result in the removal of vital supporting materials or the addition and installation of inadequate and nonengineered structural materials, thereby changing and weakening structural strength and stability.

### Fire-Weakened Structural Members

This is a common cause of structural collapse during or after a fire. Buildings that have suffered previous fire damage and have not been repaired face collapse hazards from other factors, such as high winds, shaking forces, heavy rain, etc.

### Explosions

Explosions may be caused accidentally by such things as leaking natural or propane gas, or by explosive devices. Explosions may cause the collapse and demolition of the entire building, with damage to surrounding structures. The force of the blast subjects the structural members to extreme stresses and may cause extensive amounts of debris and demolished construction materials to be blown throughout the inside of the structure and into the surrounding outside area. The number of survivable void spaces may be limited and victims may be found anywhere in the debris. Injuries related to explosions are generally severe.

### Collision Impact

Structural collapse may be caused by collision from various types of transportation vehicles or heavy equipment. Generally, the collapse area is localized, but may be complex due to the victim locations in the vehicle, victims in the structure, and the potential for spillage of fuel and cargo.

### Progressive Collapse

Progressive collapses are a chain reaction caused by the collapse of one structure or part of a structure onto another structure. Walls, floors, or entire buildings may collapse progressively in domino fashion.

## **Examples of Structural Collapse**

The following examples of major incidents occurred from the 1980s through the present. Many of these incidents focused national attention on our capability to manage and perform search-and-rescue operations at structural collapse incidents. That focus has resulted in improvements in construction techniques and response capability.

### Harbor Cay Condominium Collapse (Cocoa Beach, Florida, 1981)

This building was under construction at the time of collapse. Heavy floor and wall construction consisted of precast reinforced concrete slabs and cast-in-place concrete components. All five floors and the roof of the condominium collapsed in a pancake configuration, trapping a large

number of construction workers. Eleven were killed and 23 injured. The incident involved more than 60 hours of continuous rescue operations and resources from five county fire districts; 16 municipal fire departments; and a response of Civil Defense, military, and private-sector technical specialists.

#### Hyatt Regency Sky Walk Collapse (Kansas City, Missouri, 1981)

During a large social event at the hotel, two suspended walkways overloaded with people collapsed from 50 feet above the atrium, leaving 113 people dead and 186 injured. The suspended walkways, constructed of structural steel and lightweight concrete, spanned 120 feet across the atrium space, above hundreds of people on the floor below. The high number of dead and injured, the location of the collapse, the size of the collapsed material, and the ineffectiveness of the typical emergency service tools created severe rescue limitations. The incident required a large number of medical personnel working alongside the rescuers. Twenty-nine live victims were removed from under the debris during the rescue operations. Heavy rigging and construction specialists and heavy equipment were needed to remove the debris during the rescue operations.

#### Mexico City Earthquake (Mexico City, Mexico, 1985)

The devastating Mexico City earthquake caused the collapse of more than 264 major structures (many were 10 to 18 stories tall) and widespread damage and partial collapse of more than 7,000 smaller structures. The quake also had a major impact on the city's infrastructure, causing many problems for the responders as well as the victims. It is estimated that more than 20,000 of the 18 million residents of the city were killed, 30,000 injured, and more than 300,000 left homeless. This incident clearly focused the attention of the world on the problem of collapsed structure search and rescue and major incident management. It also brought to light the high degree of risk and danger associated with collapse rescue operations, inasmuch as more than 100 rescue personnel died during rescue operations (the majority were killed in a major aftershock that caused additional collapses).

#### Murrah Federal Building Bombing (Oklahoma City, Oklahoma, 1995)

This act of terrorism killed 168 people, injured more than 600, and destroyed a nine-story, multitenant Federal office building in downtown Oklahoma City. Additionally, it severely damaged dozens of other building in close proximity. This was the first large-scale deployment of the Federal Urban Search and Rescue (US&R) system in the aftermath of a terrorist attack.

### September 11, 2011, Terrorist Attacks on the Pentagon and the World Trade Center

These events killed over 3,000 people and injured over 6,000. The subsequent collapse of World Trade Center (WTC) Towers 1 and 2 killed 343 firefighters and 75 police officers--the single largest loss of life in the history of the fire service. The response to these events brought all 28 of the Federal US&R teams to assist, as well as numerous State and local collapse rescue-response teams. The recovery operation for the WTC lasted for 8 months. The response to the attack on the Pentagon resulted in one of the largest shoring operations ever performed and is cataloged in the student addendum CD.

Numerous other incidents involving structural collapse occurred during the 1980s. They challenged and expanded the concepts of US&R operations and incident management. Among these incidents are the following:

- Hurricane Alicia, Texas, 1982;
- Propane explosion and collapse, Buffalo, NY, 1983;
- Coalinga earthquake, Coalinga, CA, 1983;
- L'Ambiance Plaza collapse, Bridgeport, CT, 1987;
- Whittier Narrows earthquake, Los Angeles area, 1987;
- Department store collapse, Brownsville, TX, 1988;
- Armenian earthquake, Soviet Armenia, U.S.S.R., 1988;
- Building collapse, West 31st Street, New York City, 1988;
- Loma Prieta earthquake, San Francisco Bay area, 1989;
- Hurricane Hugo, East Coast United States, 1989; and
- San Bernardino train derailment and structural collapse, California, 1989.

The 1990s and 2000s have been decades of continuous challenges in structural collapse rescue and emergency management. They have also been the decades that saw the most advances in these operations, with improved tools and equipment, search-and-rescue techniques, safety requirements, training, additional resource capabilities and coordinated response, and the expanded use of the Incident Command System (ICS). Some examples of significant incidents are the following:

- Explosion and collapse of the Crested Butte State Bank, Colorado, 1990;
- Hurricane Andrew, Southeast Florida, 1992;
- Explosion, World Trade Center, New York City, 1993;
- Northridge earthquake, Los Angeles area, 1994;
- Explosion, Murrah Federal Building, Oklahoma City, OK, 1995;
- Kobe earthquake, Kobe, Japan, 1995;
- Explosion, Humberto Vidal Building, Puerto Rico, 1996;
- Tornadoes, Southeast Michigan, 1997;
- Tornadoes, Atlanta, GA, 1998;
- Earthquakes, Izmit and Douje, Turkey, 1999;
- Bombing, U.S. Embassy, Nairobi, Kenya, 1999;
- Earthquake, Taiwan, 1999;

- Terrorist attacks, World Trade Center and Pentagon, 2001;
- Earthquake, Bam, Iran, 2003;
- Hurricane Katrina, Gulf Coast of United States, 2005; and
- Earthquake, Haiti, 2009.

Structural collapse incidents should be considered high-risk, low-frequency events. The rescue of trapped victims may be both complex and dangerous, involving the response of various levels of capability in a time-critical situation to locate and remove trapped or injured victims safely from the collapsed structure.

### **Hazards**

Structural collapse creates many hazardous conditions for the rescuers, who may suffer injury, illness, psychological problems, or even death. A hazard is anything presenting a risk or danger to the rescue effort. The best methods to reduce the risks of injuries or illness during the rescue operation are prevention and avoidance. Rescue personnel can reduce the threats inherent in rescue operations through knowledge and awareness of potential hazards.

Types of threats that may be encountered by the responder are discussed below.

### **Physical**

Two common threats that can be encountered are atmospheric contamination and changes in temperature that affect bodily functions.

Atmospheric contamination may involve a toxic or flammable condition, or a reduced level of oxygen, sometimes found in confined spaces. The proper safety equipment, air monitoring devices, and operational procedures are necessary in these environments.

The human body functions efficiently within a narrow temperature range. During rescue operations, responders may be exposed to cold or heat over a prolonged time, or may experience a rapid increase or decrease in temperature that affects normal bodily functions.

In many rescue operations, **dehydration** is a problem that affects both victims and rescuers. An environment does not have to be dry for dehydration to occur. Adequate fluid intake prevents dehydration.

**Adequate nutrition** may be a problem in long-term rescues. Food is fuel for body functioning and inadequate nutritional intake can impair performance. Physical exertion and the stress of rescue operations require high-energy output. A high-energy output with a lack of readily available energy may result in a weakened physical status, reduced coordination, irritability, or increased susceptibility to hypothermia.

**Overeating** can reduce both physical and mental performance because the blood required for the digestive process is not available for other bodily activities. Adequate nutrition can be provided through a supply of high-energy foods and the consumption of small meals on a periodic basis.

Good **physical conditioning**, providing both strength and stamina, is important for the rescuer because it allows prolonged exertion and the peaks of power needed to perform rescue activities. Emergency responders should participate in regular exercise programs that promote conditioning.

### Medical

Medical threats may include **preexisting conditions** such as heart disease, lung disease, or diabetes, and certainly pose a serious threat to the rescuer and to the rescue operation. Responders with known preexisting medical problems should not participate in rescue operations.

**Short-term medical problems** such as headaches and stomach disorders or minor cuts and scrapes may be more of an annoyance than an emergency, but could become debilitating and, if not treated, may take the responder out of action. Short-term medical problems should be taken care of before they become debilitating. In any case, we do not want the rescuers to become part of the problem. They are part of the solution and must be able to perform at their highest capacity.

### Environmental

Extreme working environments caused by cold, wet, or hot weather affect the human body and can cause hypothermia or heat exhaustion. Confined spaces or enclosed areas may also cause similar problems. Body core temperature differences of only a few degrees cause bodily malfunctions in such areas as thinking, judgment, and coordination. As the temperature moves away from the normal range, dysfunction increases, and unconsciousness or even death may result.

**Hyperthermia** is caused by exposure to heat. Increased body temperature may result in heat exhaustion or heat stroke, which may be fatal if not treated.

**Hypothermia** is caused by exposure to cold and results in the lowering of the body core temperature. The body's neurological and psychological systems are affected, causing impaired mental functions, loss of coordination, unconsciousness, and, if the process continues, death.

Exposure to chilling winds or water may cause **frostbite**, which, if prolonged, freezes and destroys body tissue. Susceptible areas are feet, hands, ears, and nose.

The danger of **hazardous materials** released in a structural collapse should be considered a factor at nearly every incident. The type of occupancy is a factor in assessing this risk, as is the availability of monitoring equipment. Product identification is critical in determining the methods used to respond to and mitigate the problem.

**Biohazards** from body fluids are a hazard to rescuers working around injured or deceased victims. Suitable precautions should be taken to protect the rescuer.

### External

External threats include those caused by terrain, unstable surfaces, electrical shock, falling objects, and the risk of falling.

**Terrain** may present major obstacles to search-and-rescue operations, such as distance to site, access, obstacles, and hazards. These factors may increase time to reach the rescue site and result in extreme physical exertion for rescuers.

Collapsed structures may present the **risk of falling**, which could result in injury or death. Working in elevated situations may require the use of barrier lines to prevent access to dangerous edges, the use of safety lines to belay persons at risk of falling, the wearing of safety equipment, and the designation of a Safety Officer (SO).

Any surface that must be negotiated, and where there is the potential for a fall or loss of control, is an **unstable surface**. Unstable surfaces may not have the strength to support weight--i.e., the pound-force per square inch (psi) of the supporting surface is less than the psi of the weight of the rescuer(s). Any questionable or untested surface must be considered hazardous. These areas must be identified and either avoided or made safe. Unstable surfaces may also be caused by the presence of slippery materials such as water or oil on a concrete or metal surface. These problems may be mitigated by identification, use of safety equipment, avoidance of the area, reduction of exposure in the area, or removal of the hazard.

**Electrical shock** may be caused by **electrical current** in wires or equipment. Collapsed structures or standalone electrical hazards should be deenergized or avoided by establishing a danger zone around the hazard.

**Lightning** may be a threat to rescuers in certain areas. Develop a safety plan to include criteria for suspension of rescue operations, avoiding metal surfaces, projections, and conductive surfaces.

### Falling Objects

Areas where rescuers are most likely to encounter falling objects, such as around an unstable collapsed structure, should be designated a collapse hazard or fall zone. Personnel should be observant and wear safety equipment. An SO and assistants may be used to warn of danger or to assist in mitigating the hazard of potential falling objects by securing or removing them. Signals and escape routes should be understood by all persons working in the hazard area.



### Avalanches and Landslides

Avalanches or landslides may cause or threaten to cause structures to collapse, thereby placing rescuers in potentially dangerous situations on the lower side of the slope. Information, communication, and emergency plans are critical for this type of rescue.

### Psychological

Psychological impacts from the rescue operations may include stress or anxiety from the fear of heights (acrophobia) or of enclosed places (claustrophobia). We need to recognize the signs and symptoms, communicate our concerns, and obtain professional guidance.

Stress during rescue operations and after (delayed stress) may have many causes, and those with stress may exhibit many symptoms, such as irritability, chronic fatigue, difficulty sleeping, changes in social behavior, etc. It is important for agencies to have a Critical Incident Stress Management (CISM) program in place prior to an incident.

## **SAFETY CONSIDERATIONS**

Structural collapse results in many unsafe conditions for the rescuer and victim. Possible safety issues include

- unstable rescue areas (creating the possibility of secondary collapse);
- confined spaces;
- flammable or toxic hazards;
- oxygen-deficient atmospheres;
- ignition sources; and
- sharp, irregular, or unstable surfaces.

Safety considerations are a high priority in the response and management of a structural collapse incident. The following five issues always should be considered if you are involved in such an incident.

1. Safety starts with preplanning and training.

Understanding the causes and hazards of collapsed structures provides the knowledge needed to develop standard operating guidelines (SOGs) and training programs for the rescuers. An integral part of this preparedness phase is safety. Identify equipment requirements that provide the level of safety needed for the rescuers in various types of potentially hazardous environments.

2. Use the ICS.

The ICS provides an effective, all-hazard incident management tool that incorporates safety into the organization; from the responsibility of the Incident Commander (IC), to the SO, to all personnel in the incident organization. Responsibility and accountability are major components of the ICS.

3. Provide an SO, a safety plan, and a Rapid Intervention Crew (RIC) or company.

Risks must be reduced and managed through a variety of methods, including the establishment of safety plans which may be a written part of the Incident Action Plan (IAP); the designation, where needed, of an SO and assistants who have direct responsibility and authority for scene safety; and the deployment of an RIC to be on immediate response standby at the incident for contingencies involving the rescue of response personnel.

4. Use a personnel accountability system.

The location of response personnel during search-and-rescue operations is critical to their safety. It becomes the individual's responsibility to make sure that supervisors are aware of his/her location and the supervisor's responsibility to know where subordinates are at any given time. Good discipline, training, communications, and an adequate accountability system are essential to the safety of the rescuer in these hazardous environments.

5. Require protective clothing and equipment.

The level of protection must be determined for the hazard before rescuers enter the hazard zone.

6. Establish medical unit and responder rehabilitation.

Protection and care for the emergency responders should begin as soon as possible and continue throughout the event.

7. Consider using field observers.

Consider the use of field observers to monitor the overall operations and physical status of the rescuers.

## **RESPONSE VERSUS RECOVERY OPERATIONS**

Many times, structural collapse incidents leave survivors as well as deceased victims. The priority of efforts should be directed toward the safe location and removal of the live victims. Some incidents result in the deaths of all those in or around the structure. Survivability factors change our priorities and the margin of the risks we take versus the benefits of the resultant rescues.

## **Response Operations**

**Response operations** involve the search for, and rescue of, live victims. Many times, the rescue operation involves "the delicate application of force" to extricate victims safely and quickly.

**Time is a critical factor in the survivability** of the trapped or injured victim. The initial strategy should include a time factor for completing various rescue objectives with the commensurate deployment of resources adequate for the job. Victim condition, viability, and location are all factors in determining response priorities.

**Risk/Benefit and safety are major considerations** in the response phase. Hazard identification and the development of a risk management plan are essential parts of the development of the strategy used in the response operation. Risks to the rescuer must be minimized or eliminated if possible. A decision not to send in rescuers may have to be made in order to ensure the safety of rescue personnel. A thorough sizeup is needed and intelligence is vital to the development of the response plan.

**The general strategy in response is  
"Do the greatest good for the greatest number  
in the shortest period of time."**

## **Recovery Operations**

**Recovery operations** involve the removal of the deceased victims, as well as personal items, equipment, etc., from the structure.

**Time is not a critical factor.** Taking additional safety precautions, such as adding more shoring or using heavy equipment for debris removal, reduces the risk level to the rescuer. These tactics help protect the rescuers from potential hazards by making the rescue site safer to work in and reducing the exposure of the rescuer to injury.

The decision to move to the recovery phase from the response phase of operations may be difficult to make without very accurate information about the victims in the structure. Victims trapped in structural collapses have survived in void spaces for up to 2 weeks.

Recovery of personal items, important materials, and equipment from a structure after the removal of live victims and the deceased should be organized using a specialized task force or group, including the fire department for access and safety, the police department for identification of ownership and security, and public works or private contractors to assist with structural stabilization. Sites or areas for recovery should be prioritized by the IC.

A CISM program should be in place. A major factor causing stress for the rescuer is the body recovery operation. A prebriefing and a defusing of rescue personnel should be strongly considered, along with limited exposure in the area and adequate rehabilitation.

Law enforcement and the coroner are involved in the recovery and investigation. These incidents require effective coordination, the preservation of evidence, and a logistics system that may be required to support a long-term operation (longer than 2 weeks). Prior to these incidents, there is a need to train with the other organizations who would be involved in them. These include the Federal Bureau of Investigation (FBI), Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), or any other appropriate agency.

The final stages of the recovery operation involve stabilizing the structure and providing security for the site. Stabilization may involve the fire department, structural engineers, and private contractors with heavy equipment and materials to complete the task. Site security should be handled by the local police or private security services, depending on the type of occupancy and ownership. A crime scene or terrorist events would have different and stricter requirements, up to and including involvement of the FBI, ATF, and other Federal agencies.



# NOTE-TAKING GUIDE



NOTE-TAKING GUIDE

Slide 1-1

**Incident Command System  
for Structural Collapse  
Incidents**

Federal Emergency Management Agency (FEMA)  
National Fire Academy (NFA)

Slide 1-1

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Slide 1-2

**Unit 1:  
Introduction**

Slide 1-2

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Slide 1-3

**Administrative Matters**

• Class roster	• Class Incident Commander (IC)
• Dining hall	• Superintendent luncheon representative
• Vehicle parking	• Class dinner representative
• Coffee breaks	• Class shirts representative
• Daily schedule	
• Restrooms	
• Fire exits	
• No smoking	
• Computer room hours	

Slide 1-3

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Slide 1-4

**Cell Phones and Pagers**

- Cell phones and pagers shall be in the "off" or vibrate position.
- It is not acceptable to answer or make cell phone calls during class.
- Phone calls may be made at breaks or before and after class.
- Please do not text message during class.
- Please do not bring laptop computers to class.

Slide 1-4

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Slide 1-5

**Student Introductions**

- Name/Title
- Department
- Years of experience in fire service
- Collapse experience
- Size of community
- Present responsibilities
- Course expectations



Slide 1-5

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Slide 1-6

**Terminal Objective**

The students will be able to describe key aspects of a structural collapse.

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Slide 1-7

### **Enabling Objectives**

The students will:

- Identify hazards and conditions associated with a structural collapse.
- Understand the causes and complexities of structural collapses.
- Describe the difference between response and recovery operations.

Slide 1-7

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Slide 1-8

### **Course Goal**

To provide fire officers with an understanding of Command operations at structural collapse incidents.

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Slide 1-9

### **Why a Course on Structural Collapse?**

This course provides

- An appreciation for the complexity of structural collapse
- A review of the skills required to manage structural collapse incidents
- An appreciation of the need for effective incident management

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Slide 1-10

**Course Schedule/Units**

**Day 1**

- Unit 1: Introduction
- Unit 2: The Incident Command System  
Organizational Structure
- Unit 3: Response Resource Capabilities
- Unit 4: Scene Management: Factors and Issues

**Day 2**

- Unit 5: Response Functions
- Unit 6: Structural Collapse: Operational Phases

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Slide 1-11

**Video:**

**"Working Fire, Volume 97-9"**

**(Metro-Dade, FL)**

Slide 1-11

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Slide 1-13

**Causes of Structural Collapse**

- Construction accidents
- Structural deterioration
- Fire, explosion, or acts of terrorism
- Natural hazards (e.g., earthquakes, hurricanes, tornados, floods, landslides)
- Transportation accidents

Slide 1-12

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Slide 1-14

### Low Frequency/High Risk

Structural collapse is considered a low-frequency but high-risk event due to:

- Complex rescues
- Dangerous rescues
- Time-critical situations
- Interface of different levels of rescue capability

Slide 1-13

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Slide 1-15

### Unsafe Conditions

- Unstable buildings
- Secondary collapse
- Confined spaces
- Flammable or toxic hazards
- Potential electrocution and drowning hazards



Slide 1-14

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Slide 1-16

### Rescuer Hazards



- Oxygen-deficient atmosphere
- Ignition source
- Sharp, irregular, or unstable surfaces

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Slide 1-17

**Video:**  
**"Gordon Graham on Risk Management"**

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Slide 1-19

**Safety Considerations**

- Preplanning and training
- Use of the Incident Command System (ICS)
- Establishment of a Safety Officer (SO), safety plan, and Rapid Intervention Crew (RIC)
- Use of a personnel accountability system
- Use of appropriate protective clothing and equipment
- Potential electrocution and drowning hazards

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Slide 1-20

**Response Operations**

- Searching for live victims
- Rescuing live victims
- Realizing that time is a critical factor for survival
- Considering risk/benefit factors
- Considering safety factors

Slide 1-18

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Slide 1-21

### **Recovery Operations**

- Removal of deceased victims and personal property
- Realizing that time is not critical
- Using additional safety precautions (when possible)
- Using Critical Incident Stress Management (CISM)
- Working with law enforcement and coroner in investigation and recovery operations
- Stabilizing and securing the incident site

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Slide 1-22

### **Summary**

Structural collapse incidents require

- An effective ICS
- Resource capability commensurate with the rescue operation
- Scene safety
- Response operations to rescue live victims
- Recovery operations to remove deceased victims
- Training with other organizations

Slide 1-20

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## ***UNIT 2: THE INCIDENT COMMAND SYSTEM ORGANIZATIONAL STRUCTURE***

### ***TERMINAL OBJECTIVE***

*The students will be able to explain basic Command procedures and Incident Command System (ICS) organizational structure.*

### ***ENABLING OBJECTIVES***

*The students will:*

- 1. Identify the functions of an Incident Commander (IC).*
  - 2. Describe operational elements within the Command structure.*
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## INTRODUCTION TO THE INCIDENT COMMAND SYSTEM

The Incident Command System (ICS) should be considered the basic Command system to use for any size or kind of structural collapse incident. The only difference between using the ICS for a very large incident and using it for a small incident is expanding the basic emergency Command organization to meet the increased needs of the larger incident. The ICS organization is flexible, adaptable, and very effective for structural collapse incidents requiring a number of major functions and multiagency or multijurisdictional response. Some of the primary features of the ICS include common responsibilities, limited span of control, incident action planning, and the establishment and use of incident facilities.

Every incident has certain major management activities or actions that must be performed. Even if the incident is small and only one or two people are involved, these activities are always performed to some degree. The ICS organization is built around five major incident management functions:

1. Command.

This function sets objectives and priorities and has overall responsibility at the incident.

2. Operations.

Operations conducts tactical operations to carry out the plan, develops the tactical objectives, organizes tactical units, and directs all tactical resources.

3. Planning.

Planning develops the action plan to accomplish the objectives, collects and evaluates information, and maintains Resource Status (RESTAT).

4. Logistics.

Logistics provides support to meet incident needs. This function also provides resources and all other services needed to support the incident.

5. Finance/Administration.

This function monitors costs related to the incident and provides accounting, procurement, time recording, and cost analysis.

## **COMMAND STRUCTURE AND GENERAL STAFF**

As a small incident escalates into a major incident, additional organizational support is required. The Incident Commander (IC) can become overwhelmed and overloaded quickly with information management, assigning companies, filling out and updating the tactical worksheets, planning, forecasting, requesting additional resources, talking on the radio, and fulfilling all the other functions of Command. The immediate need of the IC is support. As additional ranking officers arrive on the scene, the Command organization may be expanded through the involvement of officers and staff personnel to fill the Command and General Staff positions of the ICS organization.

Section- and unit-level positions within the ICS are activated only when their functions are required by the incident.

Until such time as a section or unit is activated, all functions associated with that section or unit are the responsibility of the IC or the appropriate section chief. It may be necessary to combine two or more units into a single unit.

The Command structure defines the lines of authority. The transfer of information within the ICS, however, is not restricted to the lines of the chain of command. An individual will receive orders from a superior, but may give information to any position in the organization within the guidelines specified in the operational procedures for each position.

The majority of positions within the ICS are not activated until the initial response is determined to be insufficient to handle the situation. When this occurs, qualified personnel are requested, through normal dispatching procedures, to fill the positions determined to be required for the type of incident in progress. If it is later determined that a specific position is not needed, the request can be canceled. Some agencies have elected to use a modular form of dispatching entire units or Incident Management Teams (IMTs).

The transition from the initial response to a major incident organization is evolutionary. Positions are filled as the corresponding tasks are required.

### **The Incident Commander**

Overall, the IC concentrates on the "big picture." The IC focuses on the strategic plans of the entire incident and manages Command and General Staff positions.

Responsibilities include

- reviewing and evaluating the plan (and initiating needed changes);
- providing ongoing review of the overall incident;
- directing Command and General Staff positions;
- reviewing the organizational structure (and initiating changes or expansion as needed);

- staffing Command and General Staff positions; and
- establishing liaison with other internal agencies and officials, outside agencies, and property owners or tenants.

During the initial phases of the incident, the IC normally carries out the functions of these four sections:

1. Operations.
2. Planning.
3. Logistics.
4. Finance/Administration.

### **General Staff**

The functions of Operations, Planning, Logistics, and Finance/Administration comprise the General Staff within a fully expanded Incident Command Structure.

Section-level positions can be implemented at any time, based on the needs of the incident. Typically, Operations is one of the first sections to be implemented.

### **Operations Section**

The Operations Section is responsible for the direct management of all incident tactical activities, the tactical priorities, and the safety and welfare of the personnel working in the Operations Section. The Operations Section Chief (OSC) uses an appropriate radio channel to communicate tactical objectives to the branches, divisions, or groups.

The Operations Section is implemented most often (staffed) to maintain an effective span of control. When the number of branches, divisions, or groups exceeds the capacity of the IC to manage effectively, the IC may staff the Operations Section to reduce his span of control by transferring direct management of all tactical activities to the OSC. The IC is then able to focus his attention on managing the entire incident rather than concentrating on tactical activities.

Once the Operations Section is in place and functioning, the IC's focus should be on the strategic issues, overall strategic planning, and other components and functions of the incident as a whole. This focus is on the "big picture" and the impact of the incident from a broad perspective. The IC should provide direction, advice, and guidance to the Command and General Staff to ensure that the tactical aspects of the incident are managed in accordance with the strategic plan.

Figure 2-1 shows how a typical ICS Operations Section is organized.



**Figure 2-1**  
**Operations Section**

### Operations Section Chief

The OSC is responsible for the direct management of all incident strategic and tactical activities and should have direct involvement in the preparation of the action plan for the period of responsibility.

The responsibilities of the OSC may be summarized as follows:

- manages incident strategic and tactical activities;
- coordinates activities with the IC;
- implements the action plan;
- assigns resources to tactical-level areas based on tactical objectives and priorities;

- builds an effective organizational structure through the use of branches, divisions, and groups;
- provides tactical objectives for the branches, divisions, groups, and single resources;
- controls Staging and air operations;
- provides for life safety;
- determines needs and request additional resources; and
- consults with and inform other sections and the Incident Command staff as needed.

## **Staging Areas**

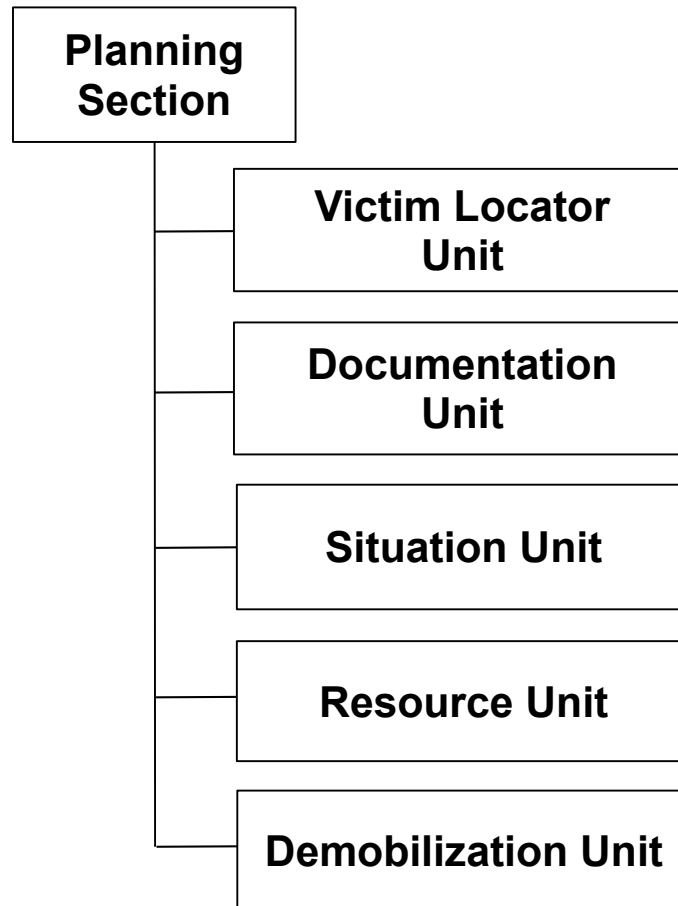
The incident scene can become congested quickly with emergency equipment if this equipment is not managed effectively. Staging Areas are locations designated within the incident area that are used temporarily to locate resources that are available for immediate assignment. For major or complex operations, the IC should establish a central Staging Area early and place an officer in charge of Staging. The radio designation "Staging" should be used for this position.

In this expanded organizational structure, the Staging Area Manager reports to the OSC. The OSC may establish one or more Staging Areas, move Staging Areas, or discontinue their use. All resources within the designated Staging Areas are under the direct control of the OSC and are available for immediate assignment. Staging requests logistical support (e.g., food, fuel, sanitation, etc.) from the Logistics Section.

## **Planning Section**

The Planning Section is responsible for gathering, assimilating, analyzing, and processing information needed for effective decision making. Information management is a full-time task at large and complex incidents. The Planning Section serves as the IC's "clearinghouse" for information. This allows the IC's staff to provide information instead of having to deal with dozens of information sources. Critical information should be forwarded immediately to Command (or whoever needs it). Information is also used to make long-range plans. The Planning Section Chief's (PSC's) goal is to plan ahead of current events and to identify the need for resources before they are needed.

Figure 2-2 shows how the Planning Section may be organized.



**Figure 2-2**  
**Planning Section**

### Planning Section Chief

The responsibilities of the PSC may be summarized as follows:

- evaluates current strategy and Incident Action Plan (IAP) with the IC;
- maintains RESTAT and personnel accountability;
- refines and recommends any needed changes to plan with Operations Section input;
- evaluates incident organization and span of control;
- forecasts possible outcome(s);
- evaluates future resource requirements;
- uses technical assistance as needed;
- gathers, updates, improves, and manages Situation Status (SITSTAT) with a standard systematic approach;

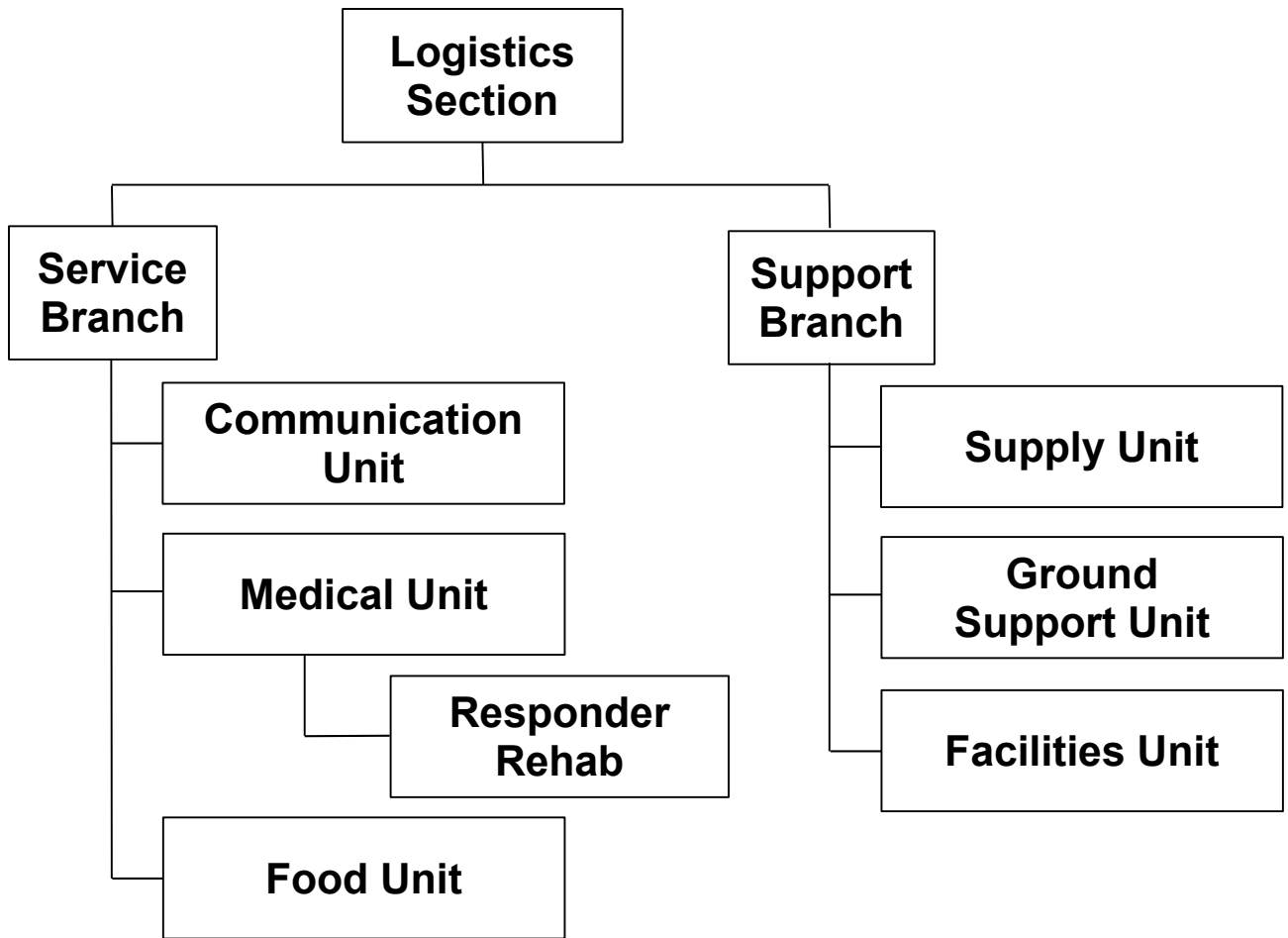
- coordinates planning needs with available outside agencies;
- plans for incident demobilization; and
- maintains incident records.

A **Victim Locator Unit** (VLU) may also be part of the Planning Section. It may begin with a Technical Specialist and develop into a full unit. The primary function of this unit is to gather intelligence that may assist in locating victims. The principal method is to interview witnesses, occupants, neighbors, and injured victims. The VLU may consist of a unit officer and a staff of fire, police, and emergency medical services (EMS) personnel. It may be assigned directly to a Search Group. This unit's primary responsibility is to determine the victim locations in the collapsed structure and to document all pertinent information to ensure that rescue operations are timely and effective.

## **Logistics Section**

The Logistics Section is the support mechanism for the entire organization. Logistics provides services and support systems to all the organizational components involved in the incident, including facilities, base, transportation, supplies, equipment maintenance, fueling, feeding, communications, and medical services, to include responder rehabilitation.

The organization of a Logistics Section is illustrated in Figure 2-3 below.



**Figure 2-3**  
**Logistics Section**

### Logistics Section Chief

The responsibilities of the Logistics Section Chief (LSC) may be summarized as follows:

- provides medical aid to incident personnel and manages responder rehabilitation;
- coordinates the immediate Critical Incident Stress Management (CISM) function;
- provides and manages any needed supplies or equipment;
- forecasts and obtains future resource needs (coordinates with the planning section);
- provides a communications plan and communications equipment;
- provides fuel and equipment repairs;
- obtains specialized equipment or expertise required by Command;
- provides food and associated supplies;
- secures fixed or portable sanitary facilities;
- develops transportation and traffic plans;
- provides any other logistical needs as requested by Command; and

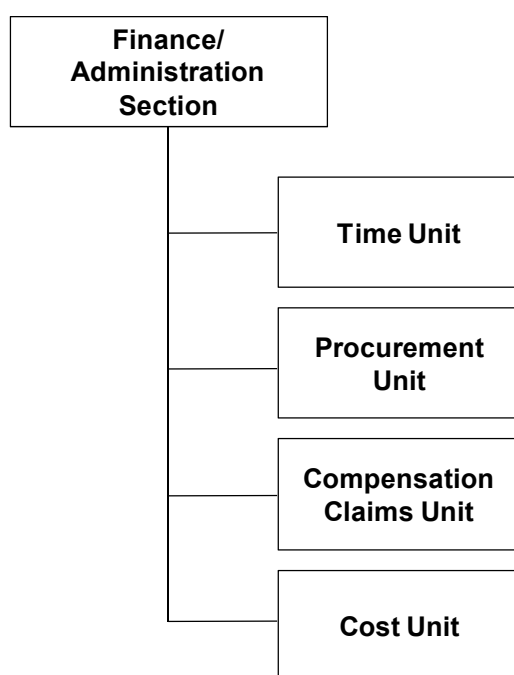


- supervises assigned personnel.

## **Finance/Administration Section**

The Finance/Administration Section is established on incidents when agencies involved have a specific need for financial services. Not all agencies require the establishment of a separate Finance/Administration Section. When only one specific function is required, such as cost analysis, that position can be established as a Technical Specialist in the Planning Section.

The organization of a Finance/Administration Section is illustrated in Figure 2-4.



**Figure 2-4**  
**Finance/Administration Section**

### Finance/Administration Section Chief

The responsibilities of the Finance/Administration Section Chief may be summarized as follows:

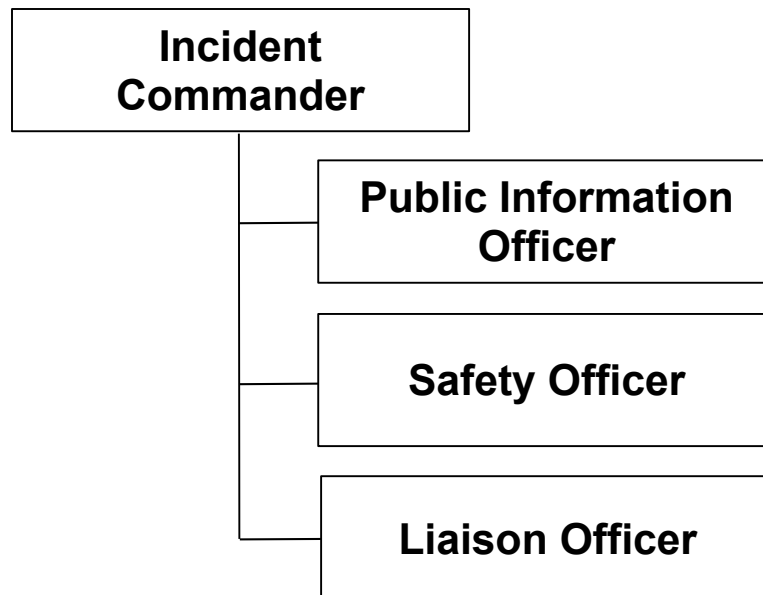
- procures services and supplies from sources inside and outside the fire department or jurisdiction as requested by Command (coordinates with Logistics);
- documents all financial costs of the incident;
- documents for possible cost recovery of services and supplies;
- analyzes and manages legal risk for incidents (e.g., hazardous materials cleanup or building demolition);
- documents for compensation and claims of injury;
- obtains any and all needed incident documentation for potential cost-recovery efforts; and
- is responsible for all legal aspects of the incident.

This position may be staffed by a trained civilian if appropriate.

### **Command Staff**

Command Staff positions are established to assume responsibility for key activities that are not a part of the General Staff. There are three Command Staff positions:

- Public Information Officer (PIO);
- Safety Officer (SO); and
- Liaison Officer.



**Figure 2-5**  
**Command Staff Positions**

An Intelligence and Investigation position may be established depending upon the nature and location of the incident, or requirements established by the IC.

### Public Information Officer

The PIO's function is to develop accurate and complete information regarding incident cause, size, current situation, resources committed, and other matters of general interest. The PIO is the point of contact for the media and other Government agencies that desire information directly from the incident. In either a Single or Unified Command structure, only one PIO is designated. Assistants may be assigned from the parent agency or from other agencies or departments involved.

The PIO should provide a "media area" away from the Incident Command Post (ICP) and direct all the media representatives to report to that area. A Joint Information Center (JIC) may be needed. An assistant PIO should accompany the media at all times.

A structural collapse incident in your community will be a media event. The print, radio, and television media will be present. They will be seeking information, and the print and television media will want photos of the incident. The PIO will probably need a few assistants to handle the needs of the media. Frequent briefings are necessary to supply media representatives with the current and accurate information demanded for effective public relations.

### Safety Officer

The SO's function is to assess hazardous and unsafe situations and to develop measures for ensuring personnel safety. The SO has emergency authority to stop and prevent unsafe acts. In a Unified Command (UC) structure, a single SO is designated. Assistants may be required and may be assigned from other agencies or departments making up the UC. The SO ensures that a responder rehabilitation and medical unit has been established. The SO position should be implemented early in a structural collapse incident. Consider assigning assistant SOs that have structural collapse training, specifically for rescue sites.

### Liaison Officer

The Liaison Officer's function is to be a point of contact for representatives from other agencies. In a Single Command structure, the representatives from assisting agencies would coordinate through the Liaison Officer. Under a UC structure, representatives from agencies not involved in the UC would coordinate through the Liaison Officer. Agency representatives assigned to an incident should have the authority to speak on all matters for their agency.

## **COMMAND PROCEDURES**

### **Purpose**

Fire departments respond to a wide range of emergency incidents. These procedures identify standard operating guidelines (SOGs) that can be employed in establishing Command. The

system provides for the effective management of personnel and resources for the safety and welfare of personnel.

Command procedures are designed to:

- fix the responsibility for Command on a specific individual through a standard identification system that depends on the arrival sequence of members, companies, and chief officers;
- ensure that a strong, direct, and visible Command is established from the onset of the incident;
- establish an effective incident organization, defining the activities and responsibilities assigned to the IC and to other individuals operating within the ICS;
- provide a system to process information to support Incident Command, planning, and decision making; and
- provide a system for the orderly Transfer of Command to subsequently arriving officers.

### **Responsibilities of Command**

The IC is responsible for the completion of the strategic and tactical priorities:

- locate and remove endangered occupants and treat the injured;
- stabilize the incident and provide for life safety;
- conserve property; and
- provide for the safety, accountability, and welfare of responding personnel (this priority is ongoing throughout the incident).

The ICS is used to facilitate the completion of the tactical priorities. The IC is the person who drives the ICS toward that end. The IC is responsible for building a Command structure that matches the organizational needs of the incident to achieve the completion of the tactical priorities for the incident. The functions of Command define standard activities that are performed by the IC to achieve the tactical priorities.

### **Functions of Command**

- assume and announce Command and establish an effective operating position (ICP);
- rapidly evaluate the situation (sizeup);
- initiate, maintain, and control the communications process;
- identify the overall objectives, strategies, develop an IAP, and assign companies and personnel consistent with plans and SOGs;
- develop an effective Incident Command Organization;
- support incident operations;
- review, evaluate, and revise the action plan (as needed); and
- provide for the continuity, transfer, and termination of Command.

The IC is responsible for all of these functions. As Command is transferred, so is the responsibility for these functions. The first five functions must be addressed immediately upon initial assumption of Command.

## **ESTABLISHING COMMAND**

The first fire department member or unit to arrive at the scene shall assume Command of the incident. The initial IC shall remain in Command until Command is transferred or the incident is stabilized and terminated.

The first unit or member on the scene must initiate whatever parts of the ICS are needed to manage the incident scene effectively.

A single-company incident (trash fires, single-patient EMS incidents, etc.) may require only that the company or unit acknowledge its arrival on the scene.

For incidents that require the commitment of multiple companies or units, the first unit or member on the scene must establish and announce "Command," and develop an Incident Command Structure appropriate for the incident.

The first-arriving fire department unit activates the Command process by giving an initial radio report that includes

- unit designation of the unit arriving on the scene;
- a brief description of the incident situation (i.e., building size, occupancy, hazmat release, multivehicle accident, etc.);
- obvious conditions (working fire, hazmat spill, collapsed building, multiple patients, etc.);
- brief description of action taken;
- any obvious safety concerns;
- assumption, identification, and location of Command; and
- request or release resources as required.

## **Examples**

### **Structural Collapse**

"Engine 27 is on the scene of a three-story masonry apartment house collapse with occupants trapped inside. Engine 27 is Vine Street Command and is initiating search and rescue."

### Structural Collapse

"Truck 10 is on the scene of an 11-story, steel and concrete building under construction collapse. Approximately 10 workers are trapped and injured. Seventh Street is closed because of debris. Truck 10 is Seventh Street Command and is initiating search-and-rescue operations with Engine 10. Give me a second-alarm assignment, a heavy rescue, five ambulances, and the police for traffic control. Staging is at Seventh and Flower."

### Transportation Incident

"Engine 57 is on the scene of a train derailment into the back of several dwellings at 58th Street and Vermont. There is a chemical spill that may be hazardous materials and is flowing toward 60th Street. There appear to be many injured and trapped in the dwellings. We need mutual aid. Give me a fourth-alarm assignment, two heavy rescues, a multicasualty medical assignment with 10 ambulances, a hazmat team, and the police for traffic and evacuation. Engine 57 is Vermont Command."

### Single-Company Incident

"Engine 6 is on the scene of a dumpster fire with no exposures. Engine 6 can handle."

### Radio Designation

The radio designation "Command" is used along with the geographical location of the incident (i.e., "Seventh Street Command," "Metro Center Command"). This designation does not change throughout the duration of the incident. The designation of "Command" remains with the officer currently in Command (the IC) of the incident throughout the event.

### Command Options

The responsibility of the first-arriving unit or member to assume command of the incident presents several options, depending on the situation. If a Chief Officer, member, or unit without tactical capabilities (i.e., staff vehicle, no equipment, etc.) initiates Command, the establishment of an ICP should be a top priority. At most incidents, the initial IC is a Company Officer (CO). The following Command options define the CO's direct involvement in tactical activities and the modes of Command that may be used.

### Investigation Mode

These situations generally require investigation by the initially arriving company while other units remain in a staged mode. The officer should go with the company to investigate, while using a portable radio to Command the incident.

### Attack Mode

This is used when the CO's direct involvement is required to take an immediate action that will stabilize the incident. In these situations, the CO goes with the crew to provide the appropriate level of supervision. Examples of these situations include

- initial search and rescue of surface victims;
- critical life safety situations (e.g., rescue) that must be achieved in a compressed time;
- any incident where the safety and welfare of firefighters are of major concern; and
- obvious working incidents that require further investigation by the CO.

Where fast intervention is critical, use of the portable radio permits the CO's involvement in the attack without neglecting Command responsibilities. The Attack Mode should not last more than a few minutes and ends with one of the following:

- The situation is stabilized.
- The situation is not stabilized and the CO must withdraw to the exterior and establish an ICP. At some time, the CO must decide whether or not to withdraw the remainder of the crew--based on the crew's capabilities and experience, safety issues, and the ability to communicate with the crew. **No crew should remain in a hazardous area without radio communication capability.**
- Command is transferred to a higher-ranking officer. When a chief officer is assuming Command, the chief officer may opt to return the CO to the CO's crew, or assign the CO to a subordinate position.

The Attack Mode is applicable only at incidents when the incident site is safe enough for the responders to take immediate action. The IC must make perform a risk/benefit analysis for the response. Remember, safety is the top priority.

### Command Mode

Certain incidents, by virtue of their size, complexity, or potential for rapid expansion, require immediate strong, direct, overall Command. In such cases, the CO initially assumes an exterior, safe, and effective Command position and maintains that position until relieved by a higher-ranking officer. A tactical worksheet should be initiated and used to assist in managing this type of incident.

If the CO selects the Command Mode, the following options are available regarding the assignment of the remaining crew members:

- The officer may "move up" within the company and place the company into action with the remaining members. **One of the crew members will serve as the acting CO and should be provided with a portable radio.** The collective and individual capabilities and experience of the crew regulate this action.



- The officer may assign the crew members to work under the supervision of another CO. In such cases, the officer assuming Command must communicate with the officer of the other company and indicate the assignment of those personnel.
- The officer may elect to assign the crew members to perform staff functions to assist Command.

A CO assuming Command has a choice of modes and degrees of personal involvement in the tactical activities, but continues to be fully responsible for the Command functions. The initiative and judgment of the officer are of great importance. The modes identified are guidelines to assist the officer in planning appropriate actions. The actions initiated should conform to one of the previously mentioned modes of operation and the appropriate safety precautions.

## PASSING COMMAND

Should be limited to verified rescues or when immediate intervention would mitigate the problem. This is indicated when the initial commitment of the first-arriving company requires a full crew (i.e., immediate rescue situation), and the next-arriving company will assume Command upon arrival.

"Passing Command" to a unit that is not on the scene can create a gap in the Command process and compromise Incident Command. **To prevent this "gap," Command shall not be assumed by an officer who is not on the scene.** Command can be passed to an incoming unit, but cannot be assumed until that arriving officer contacts the original officer and then assumes Command.

When a chief officer arrives at the scene at the same time as the first-arriving company, the chief officer should assume Command of the incident.

Should a situation occur in which a later-arriving company or chief officer cannot locate or communicate with Command (after several radio attempts), they assume, and announce their assumption of, Command, and initiate whatever actions are necessary to confirm the safety of the missing crew.

## TRANSFER OF COMMAND

Command is transferred to improve the quality of the Command organization. The following guidelines outline the Transfer of Command process. Local departments must predetermine the Transfer of Command (through various ranking officers).

- The first fire department member arriving on the scene automatically assumes Command. This is normally a CO, but it could be any fire department member up to, and including, the fire chief.

- The first-arriving CO assumes Command after the Transfer of Command procedures have been completed (assuming an equal or higher-ranking officer has not already assumed Command).
- The first-arriving chief officer may assume Command of the incident following Transfer of Command procedures.
- The second-arriving chief officer should report to the ICP for assignment.
- Later-arriving, higher-ranking chief officers may choose to assume Command or assume advisor positions.

Within the Chain of Command, the actual Transfer of Command is regulated by the following procedure:

- The officer assuming Command may do a preliminary sizeup prior to communicating by radio or face-to-face with the person being relieved. Face-to-face is the preferred method to transfer Command.
- The person being relieved briefs the officer assuming Command, indicating a minimum of the following information:
  - Incident conditions (fire location and extent, hazmat spill or release, number of patients, etc.).
  - Action plan for the incident.
  - Progress toward completion of the tactical objectives.
  - Safety considerations.
  - Deployment and assignment of operating companies and personnel.
  - Appraisal of need for additional resources.
- The person being relieved of Command should review the tactical worksheet with the officer assuming Command. This sheet provides the most effective framework for Command transfer because it outlines the location and status of personnel and resources in a standard form that should be well known to all members.
- The person being relieved of Command is reassigned--based on the needs of the incident --by the officer assuming Command.

## GENERAL CONSIDERATIONS

The response and arrival of additional ranking officers on the incident scene strengthens the overall Command function. As the incident escalates, the IC should use these subordinate officers as needed.

A fire department's communications procedures should include communications necessary to gather and analyze information to plan, issue orders, and supervise operations.

For example:

- sizeup;
- assignment completed;
- additional resources required;
- unable to complete the assignment; and/or
- special information (partial collapse, hazmat in area, etc.).

The arrival of a ranking officer on the incident scene does not automatically mean that Command has been transferred to that officer. Command is only transferred when the outlined Transfer of Command process has been completed. Chief officers and staff personnel should report directly to a designated location for assignment by the IC.

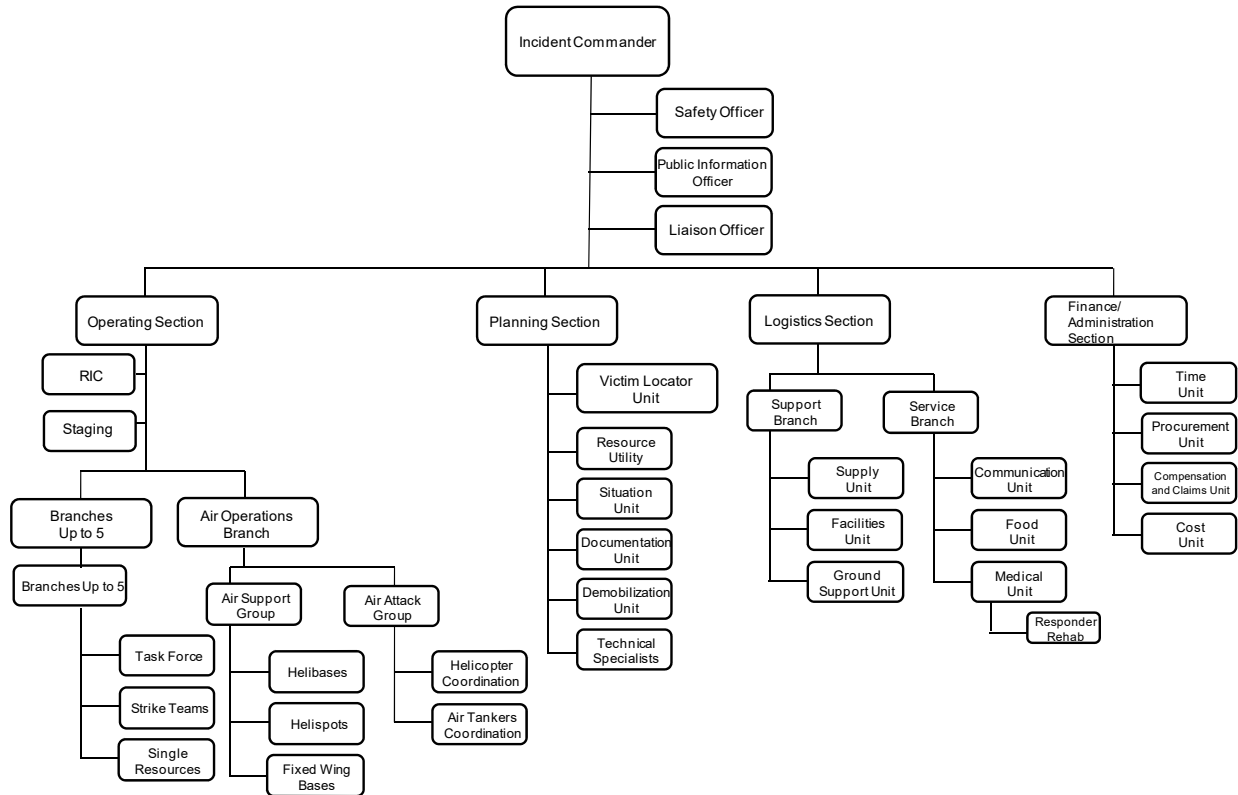
When time and circumstances allow, the officer who will be assuming Command should endeavor to do his own sizeup prior to assuming Command. It gives the officer the opportunity to see where companies are operating and an idea of their effectiveness. It also gives the officer a chance to get his own perspective and understanding of the scope and magnitude of the incident. By doing this prior to assuming Command, the officer can gain some understanding of the current action plan and ease the transition from one IC to another. The officer should announce his on-scene arrival to the IC, and advise the IC that he will be doing the sizeup. Until the officer completes the sizeup and the formal Transfer of Command process has taken place, the current IC retains Command of the incident.

The IC has the overall responsibility for managing an incident. Simply stated, the IC has complete authority and responsibility for the incident. If a higher-ranking officer wants to effect a change in the Command of an incident, the higher-ranking officer must first be on the scene of the incident, and then use the Transfer of Command procedure to assume Command.

In extreme and life-threatening situations that affect personnel safety, anyone can effect change by initiating corrective action and notifying Command.

## Command Structure

The IC is responsible for developing an organizational structure based on SOGs as soon as possible after arrival, making a sizeup, developing objectives, and implementing initial tactical control measures. The size and complexity of the organizational structure are determined by the scope of the emergency and availability of resources.



## STRUCTURAL COLLAPSE INCIDENT COMMAND SYSTEM ORGANIZATION CHART (EXAMPLE)

### Incident Command System Operations

The ICS should be considered the basic Command system to be used on any size or kind of structural collapse incident. The only difference between using the ICS on a very large incident and using it for a small incident is expanding the basic emergency Command organization to meet the increased needs of the larger incident. Thus, the full establishment of the ICS should be viewed as an extension of the existing incident organization. The decision to expand the organization is that of the IC, and is made when it is clear that the initial attack or reinforced attack is insufficient. This determination is made by the IC at the scene.

## Incident Command System Organizational Development

The following examples are guides in using the basic ICS organization for incidents of various sizes.

Initial Response	1 to 5 Increments/First Alarm
Reinforced Response	Greater Alarm/Mutual Aid

### Initial Response

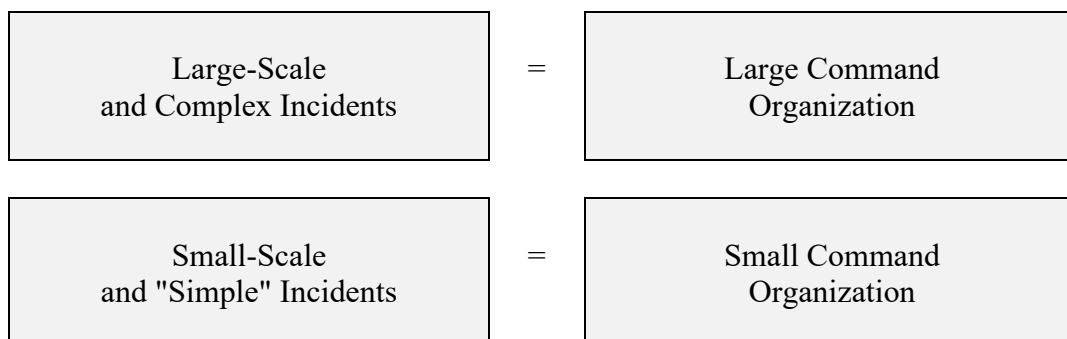
The first-arriving unit or officer assumes Command until arrival of a higher-ranking officer. Upon arrival of a higher-ranking officer, they are briefed by the onscene IC. The higher-ranking officer then assumes Command. This Transfer of Command must be announced. The officer being relieved of Command responsibilities is reassigned by the new IC.

### Reinforced Response

A reinforced response is initiated when the onscene IC determines that the initial response resources are insufficient to deal with the size or complexity of the incident.

### Command Organization

The Command organization must develop at a pace that stays ahead of the tactical deployment of personnel and resources. In order for the IC to manage the incident, they first must be able to direct, control, and track the positions and functions of all operating companies. Building a Command organization is the best support mechanism the IC can use to achieve the harmonious balance between managing personnel and incident needs. Simply put, this means



**Note:** The IC should have more people working than commanding.

## Command Objectives

The IC is responsible for the overall objectives and strategies of the Command structure. The action plan should cover all objectives, strategies, and tactics, as well as supporting activities needed during the entire operational period. The action plan defines where and when resources are assigned to the incident to control the situation. This plan is the basis for developing a Command organization, assigning all resources, and establishing objectives.

The strategic-level responsibilities include

- assessing the situation (sizeup);
- establishing overall incident objectives;
- setting priorities;
- developing an IAP;
- obtaining and assigning resources;
- evaluating progress, predicting outcomes, and planning; and
- assigning SMART objectives.

SMART Objectives:

S = Specific

M = Measurable

A = Action-oriented

R = Reasonable

T = Time

## Tactical Level

Branches, divisions, and groups direct operational activities toward specific objectives. Branches, divisions, and groups are responsible for specific geographic areas or functions and for supervising assigned personnel. A tactical-level assignment comes with the authority to make decisions and assignments within the boundaries of the overall plan and safety conditions. The accumulated achievements of tactical objectives should accomplish the strategy as outlined in the action plan.

## Task Level

The task level refers to those activities normally accomplished by individual companies or specific personnel. The task level is the level at which the work is actually done. Task-level activities are routinely supervised by COs. The accumulated achievements of task-level activities should accomplish tactical objectives.

## Example

The following example, invoking one of the largest military operations ever undertaken, is used to describe the relationship between the objective level, the tactical level, and the task level. **Operation Overlord** was the plan to invade Europe by landing on the beaches of Normandy on June 6, 1944 (focuses on United States participation in a very simplistic example of just some of the operations involved).

The objectives (what needs to be done):

- Land troops; secure and hold the Normandy beaches within 48 hours.
- Place troops inland behind enemy lines within 24 hours.
- Reinforce and support landing within 72 hours.
- Move forces inland and link with allied forces to move toward Berlin within 96 hours.

The tactical level (how it will be done):

- Land troops on beaches by amphibious landing.
- Provide naval sea bombardment and air cover.
- Drop airborne troops in behind enemy lines.
- Reinforce and support invasion with naval supply and additional troops.
- Link up with allied forces at defined areas.

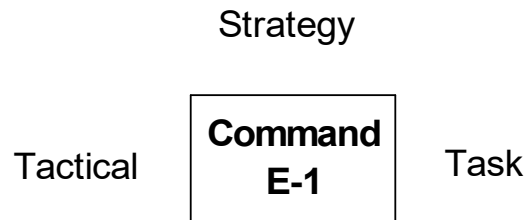
The task level (who will do it, when it will be done, where it will be done):

- On the morning of June 6, 1944, land portions of the U.S. 1st Army on Omaha and Utah beaches.
- Bomb shore defenses using U.S. Navy ships.
- Provide air cover and attack shore defenses with U.S. Army Air Corps.
- Make airborne landing in tactical support of beach landings using the 82nd and 101st Airborne around the Ste-Mere-Eglise area prior to the beach landings.
- Move remainder of 1st Army and 3rd Army into beachhead, and move troops inland toward Cherbourg, Bayeux, and St-Lo, securing occupied areas.
- Set up logistical support system to supply troops from the beaches inland.
- Link up United States forces and allied forces inland at various points along the front and continue moving forces into France.

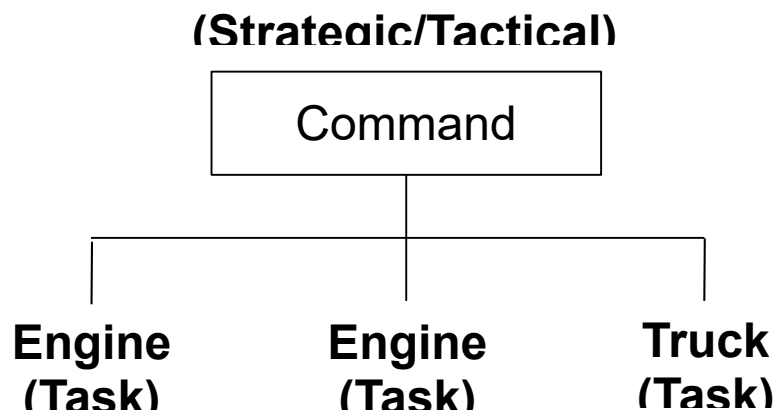
## COMMAND STRUCTURE--EXPANDING THE ORGANIZATION

### Command Structure--Basic Organization

The most basic structure combines all three levels of the Command structure. The CO on a single-engine response to a dumpster fire determines the strategy and tactics and supervises the crew doing the task.



The basic structure for a "routine" incident involving a small number of companies requires only two levels of the Command structure. The role of Command combines the strategic and tactical levels. Companies report directly to Command and operate at the task level.



### Command Structure--Division and Group

Divisions represent geographic operations and groups represent functional operations. The title of the individuals in charge of divisions or groups is "Supervisor," i.e., Division Supervisor. The following examples illustrate the use of these organizational elements.

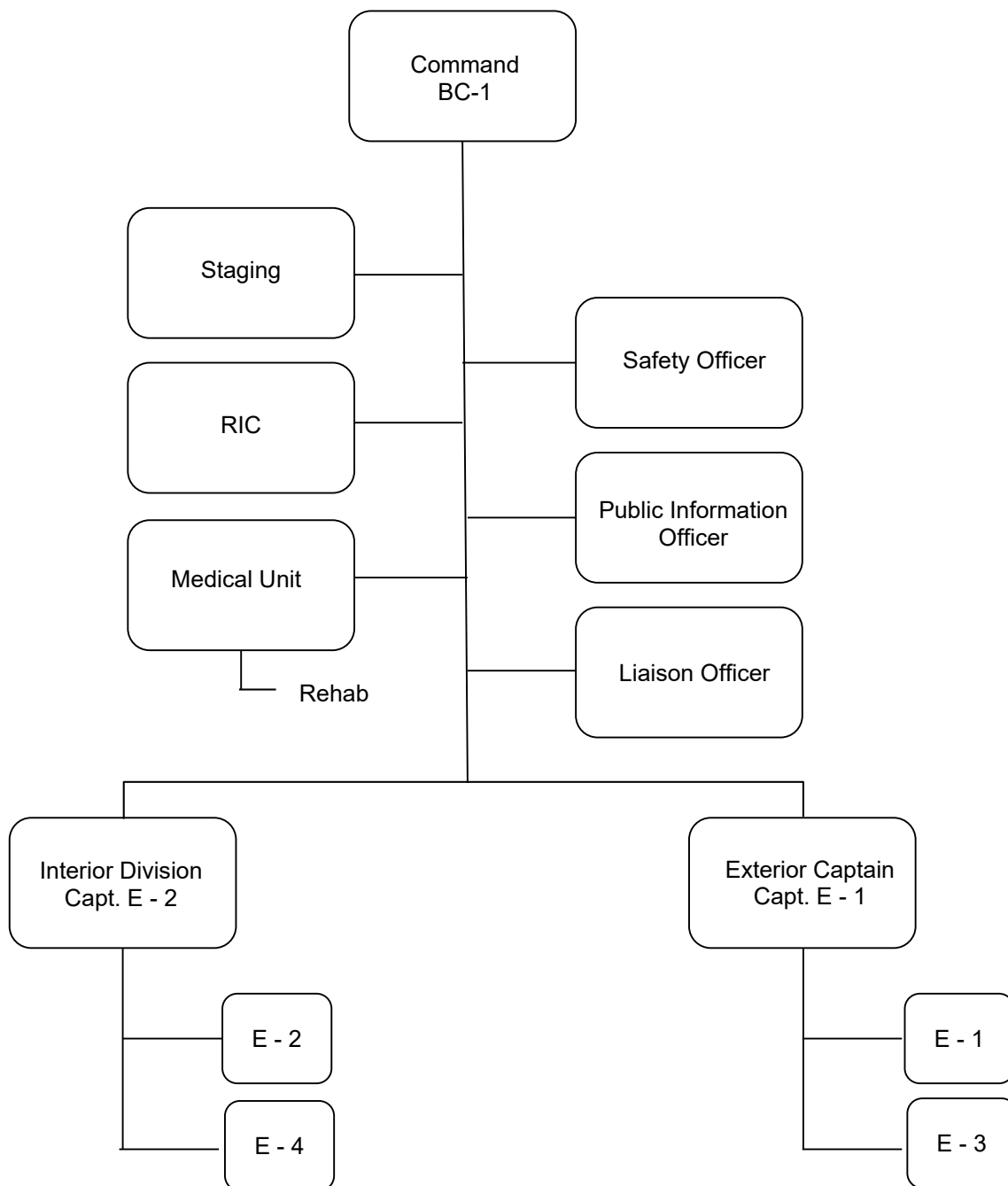
#### Divisions and Groups

As an incident escalates, the IC should group companies to work in divisions and groups to reduce span of control and increase effectiveness. A division is the organizational level having



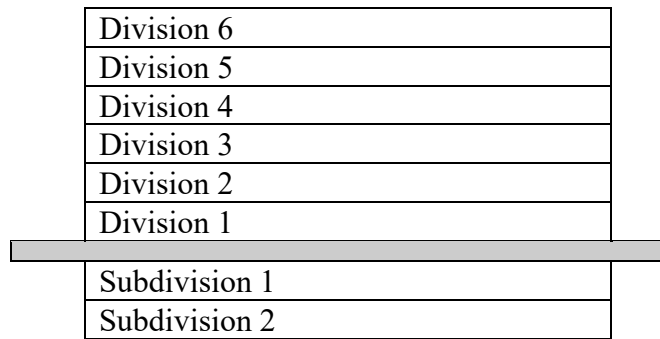
responsibility for operations within a defined geographic area. To use division and group terminology effectively, a department must have a designated method of dividing an incident scene.

## Division Designation

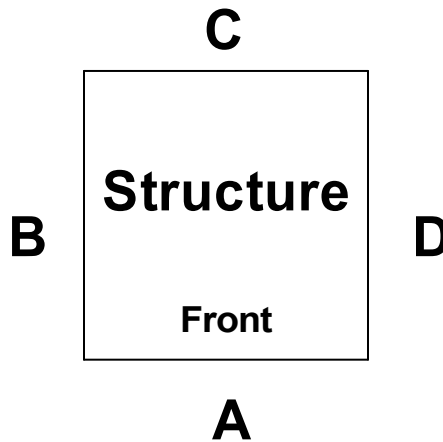


## Tactical Assignments for a Multistory Incident Division Designation

In multistory occupancies, divisions are usually indicated by floor number (Division 6 indicates sixth floor). When operating in levels below grade, such as basements, the use of subdivisions is appropriate.



Exterior approaches are identified by alphabetical letter identifiers. These letters start at the front of a building and progress clockwise around the building as illustrated. Division A always indicates the front or address side of the building.



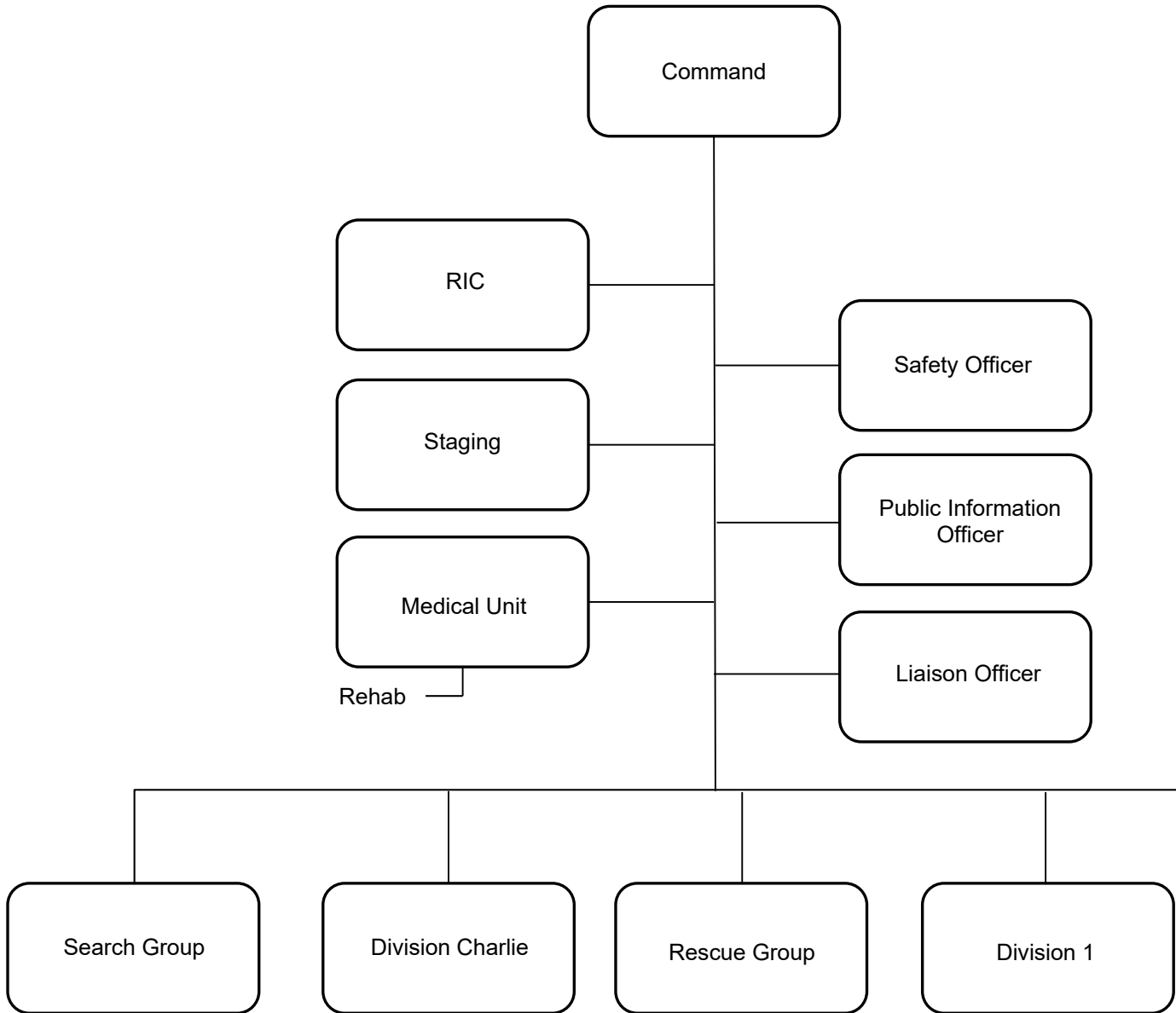
**Note:** For clarity during radio communications, the phonetic designations of "Alpha," "Bravo," "Charlie," and "Delta" are suggested. For example, "Command from Division Delta."

A division is that organizational level having responsibility for operations within a defined geographic area. The division level is organizationally situated between single resources, task force, or the strike team and the branch.

### Group Designation

Groups are an organizational level responsible for a specific functional assignment at an incident. Examples are Search Group, Rescue Group, Hazmat Group, Medical Group, Evacuation Group, and Security Group. They may be made up of a variety of resources needed to accomplish the task for which they are organized.

### Division/Group Designation



### **Command Structure--Divisions and Groups; Basic Operational Approach**

The use of divisions and groups in the Command organization provides a standard system to divide the incident scene into smaller subordinate Command units or areas.

Complex emergency situations often exceed the capability of one officer to manage the entire operation effectively. Divisions and groups reduce the span of control to more manageable, smaller-sized units. Divisions and groups allow the IC to communicate principally with these organizational levels, rather than with multiple individual COs, thus providing an effective

Command structure and incident scene organization. Generally, division and group responsibilities should be assigned early in the incident, typically to the first company assigned to a geographic area or function. This early establishment of divisions and groups provides an effective incident command organization framework on which the operation can be built and expanded.

The number of divisions and groups that can be managed effectively by the IC varies. The normal span of control is three to seven. In fast-moving, complex operations, a span of control of no more than five divisions and groups is indicated. In slower-moving, less complex operations, the IC may manage more divisions and groups effectively.

Where the number of divisions and groups exceeds the span of control that the IC can manage effectively, the incident organization can be expanded to meet incident needs by assigning a Branch Director. Each branch is responsible for several of these divisions and groups and should be assigned a separate radio channel, if available.

The division and group procedures provide an array of major functions that may be implemented selectively, according to the needs of a particular situation. This places responsibility for the details and execution of each particular function on a division and group.

When effective divisions and groups have been established, the IC can concentrate on overall strategy and resource assignments, allowing the divisions and groups to manage their assigned units. The IC determines strategy and assigns tactical objectives and resources to each division and group. Each division and group supervisor is responsible for the tactical deployment of the resources at the supervisor's disposal in order to complete the tactical objectives assigned by the IC. Division and group supervisors are also responsible for communicating their needs and progress to Command.

Divisions and groups reduce the overall amount of radio communications. Most routine communications within a division and group should be conducted face-to-face between COs and their supervisors. This process reduces unnecessary radio traffic and increases the ability to transmit critical radio communications.

The safety of firefighting personnel represents the major reason for establishing divisions and groups. Each division and group supervisor must maintain communication with assigned companies to control both their position and their function. This supervisor must constantly monitor all hazardous situations and risks to personnel. The division and group supervisors must take appropriate action to ensure that companies are operating in a safe and effective manner.

The IC should begin to assign divisions and groups based on the following factors:

- Situations that involve a number of companies or functions beyond Command's span of control. Command initially should assign responsibility for division and group operations to the first CO assigned to a geographic area or function. As additional chief officers become available, they may be assigned to relieve the CO of responsibility for the area or function.

- Situations in which companies are involved in complex operations (large interior or geographic area, multiple search operations, hazardous materials operations, technical rescues, shoring operations, etc.).
- Situations in which companies are operating from tactical positions over which Command has little or no direct control (i.e., they are out of Command's sight).
- Occasions on which the situation presents special hazards and close control is required over operating companies (i.e., unstable structural conditions, heavy fire load, marginal offensive situations, etc.).

When establishing divisions and groups, the IC assigns and advises each unit as follows:

- tactical objectives;
- a radio designation (Rescue Group, Division "A"); and
- the identity of resources assigned to the specific division and group.

### Division and Group Guidelines

Divisions and groups are regulated by the following guidelines:

- It is the ongoing responsibility of Command to assign divisions and groups as required for effective emergency operations; this assignment relates to both geographic and functional tactical assignments.
- Command advises each division and group of specific tactical objectives. The overall strategy and plan are provided if time permits, so that the supervisors of the divisions and groups have some idea of what is going on and how their assignment fits into the overall plan.
- The number of companies assigned to a division or group depends on conditions within that area of responsibility. Command maintains an awareness of the number of companies operating within a division or group and of the capability of that specific division or group to direct operations effectively. A division or group supervisor controls the resources within the division and group; it should notify the IC if additional resources are needed.
- The incident scene should be subdivided in a manner that makes sense. This should be accomplished by assigning divisions to geographic locations (e.g., Division 4, Division "A") and assigning functional responsibilities to groups (e.g., Rescue Group, Medical Group).
- Division and group supervisors use the division/group designation in radio communications (e.g., "Command from Rescue Group").

- Divisions and groups are commanded by COs, or any other fire department member designated by Command.
- The specific guideline for optimum span of control in divisions and groups is five. This applies to operational divisions and groups. Many of the Command Staff functional positions (Information, Safety, Liaison, etc.) are preassigned to certain individuals and are driven by SOGs. These types of functional responsibilities should operate automatically and, as such, should not be included in the IC's span of control.
- Regular Transfer of Command procedures should be followed in transferring division and group responsibility.
- In some cases, a supervisor may be assigned to an area or function to evaluate and report conditions and advise Command of needed tasks and resources. The assigned officer proceeds to the division or group, evaluates and reports conditions to the IC, and assumes responsibility for directing resources and operations within their assigned area of responsibility.
- The division and group supervisor must be in a position to supervise and monitor operations directly. This requires the division and group supervisor to be equipped with the appropriate protective clothing and equipment for the supervisor's area of responsibility. Division and group supervisors assigned to operate within a hazard zone must be accompanied by a partner if they are not in close proximity to operating personnel.
- These supervisors are responsible for and in control of all assigned functions within their division or group. This requires each division and group supervisor to:
  - Complete objectives assigned by Command.
  - Account for all assigned personnel.
  - Ensure that operations are conducted safely.
  - Monitor work progress.
  - Redirect activities as necessary.
  - Coordinate actions with related activities and adjacent divisions and groups.
  - Monitor welfare of assigned personnel.
  - Request additional resources as needed.
  - Provide Command with essential and frequent progress reports.
  - Reallocate or release resources within the division and group.

- The division and group supervisor should be readily identifiable and maintain a visible position as much as possible.
- The primary function of COs working within a division or group is to direct the operations of their individual crews in performing assigned tasks. COs advise their division or group supervisor of work progress, preferably face-to-face. All requests for additional resources or assistance within a division or group are made by the division or group supervisor. These supervisors communicate with Command.
- Each division and group supervisor keeps Command informed of conditions and progress in the supervisor's division or group through regular progress reports. These supervisors must limit progress reports to essential information only.
- Command must be advised immediately of significant changes, particularly those involving the ability or inability to complete an objective, or of hazardous conditions, accidents, structural collapse, etc.
- When a company is assigned from Staging to an operating division or group, the company is told which division and group it is reporting to and the name of the supervisor. The division or group supervisors are informed of which companies or units have been assigned by the IC. It is then the responsibility of these supervisors to contact the assigned company to transmit any instructions relative to the specific action requested.
- Division and group supervisors monitor the condition of the crews operating in their area of responsibility. Relief crews are requested in a manner that assures the safety of personnel and maintains progress toward the division's or group's objectives.
- These supervisors ensure an orderly and thorough reassignment of crews to responder rehabilitation. Crews must report to responder rehabilitation intact to facilitate accountability.

## BRANCHES

As previously discussed, divisions and groups identify tactical-level assignments in the Command structure. As the span of control becomes excessive, the incident becomes more complex, or it has developed two or more distinctly different operations (i.e., fire, medical, evacuation, etc.), the organization can be subdivided further into branches.

Branches may be established on an incident to serve several purposes.

In general, branches may be established for the following reasons:

- Span of control.

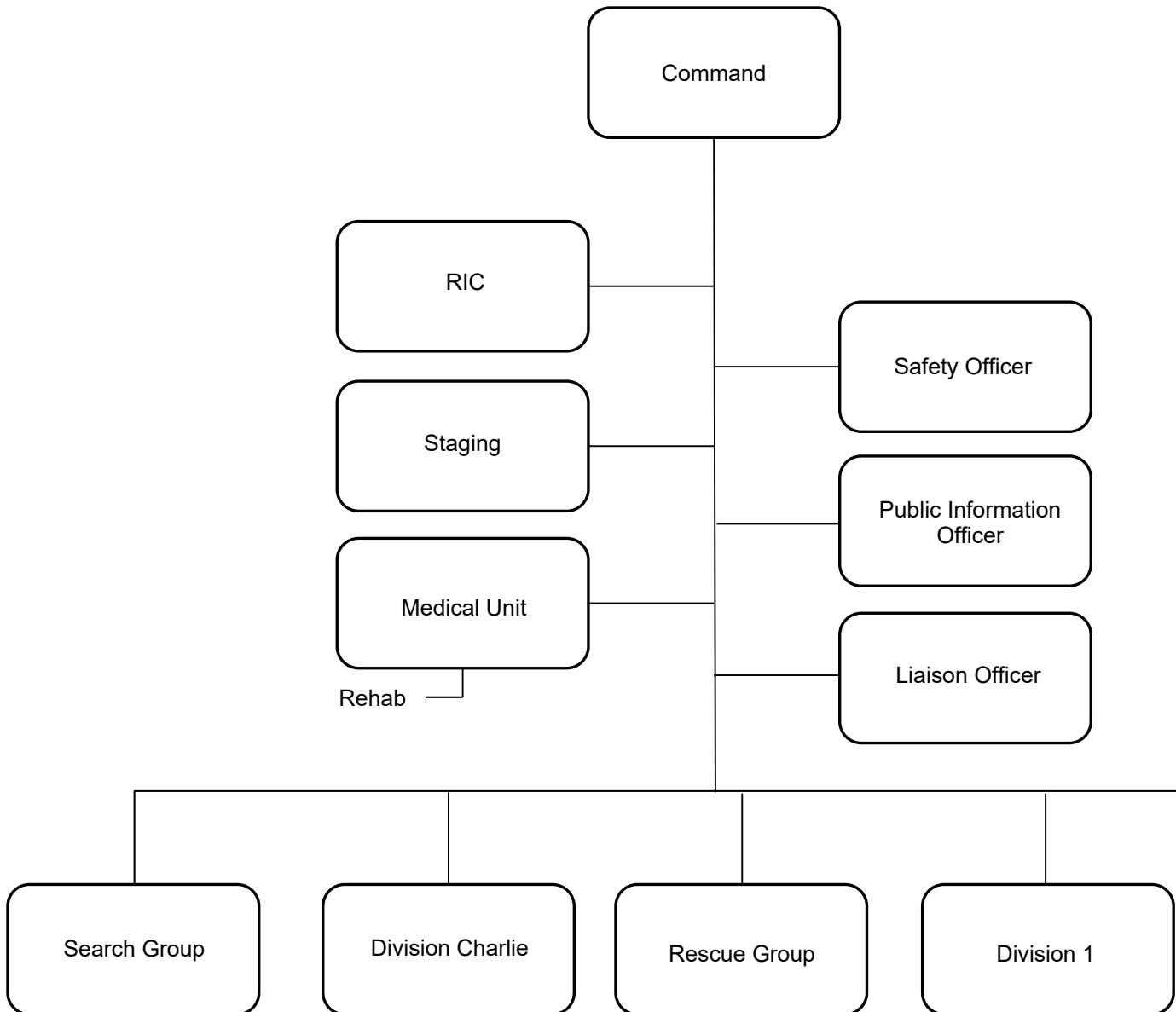


- Functionality.
- Geographical area.
- When the numbers of divisions and groups exceed the recommended span of control for the OSC, the IC or OSC should designate a multibranch structure and allocate the divisions and groups within those branches.

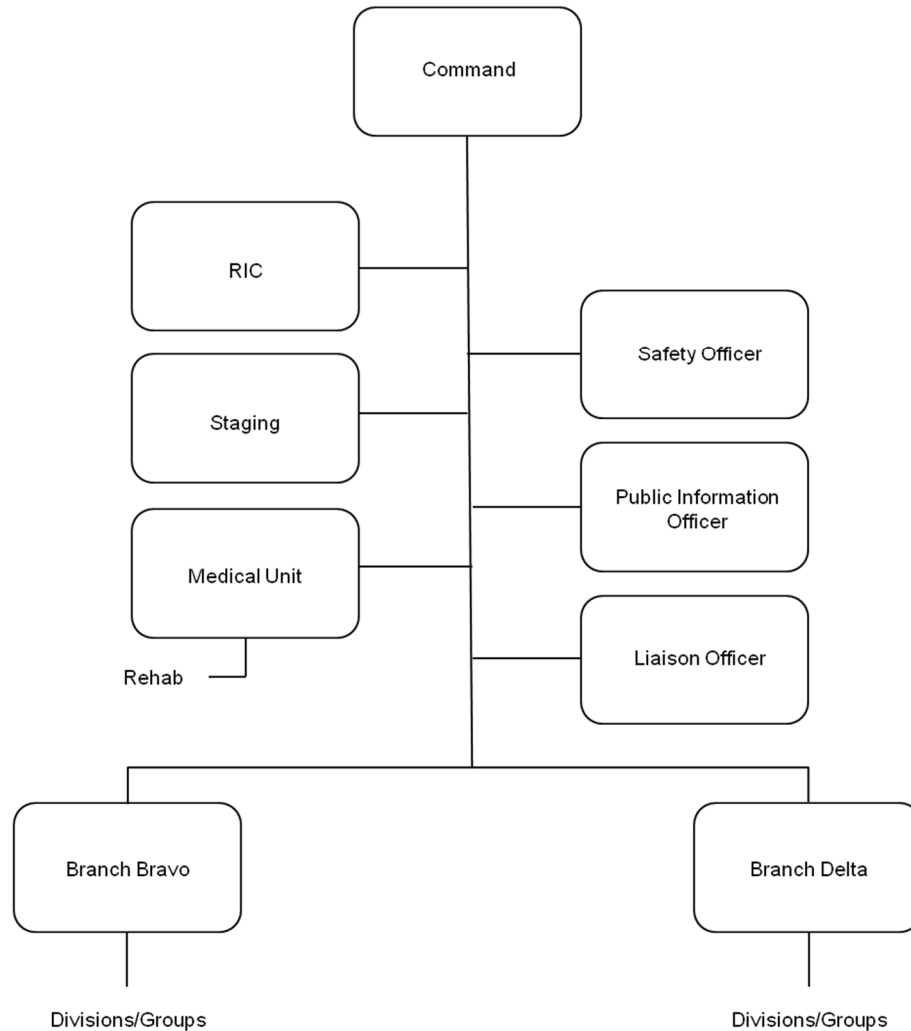
In a structural collapse incident, search, rescue, medical, exposures, and law enforcement could each become a branch operation.

In the following example, one group and four divisions report to the OSC, with one additional division and two groups being added. At this point, a two-branch organization was formed, as reflected below.

### **Before Multibranch Structure**



## Two-Branch Organization



Branches should operate in their area of responsibility on separate radio channels, and communicate to Operations on a different channel, if possible. The radio designation of branches should reflect the objective of the branch, when designating functional branches (i.e., Hazmat Branch, Multicasualty Branch, etc.). Tactical branches may be designated numerically (i.e., Branch I, Branch II, Branch III, etc.). When Operations implements branch directors, the division and group supervisors **must** be notified of their new supervisor. This information should include

- to which branch the division or group is currently assigned; and
- the radio channel on which the division or group in the branch is operating.

Radio communications are then directed from the division or group supervisor to the branches--instead of Command or Operations. Branch directors will receive from Command or Operations their direction, which will then be relayed to the division and groups.

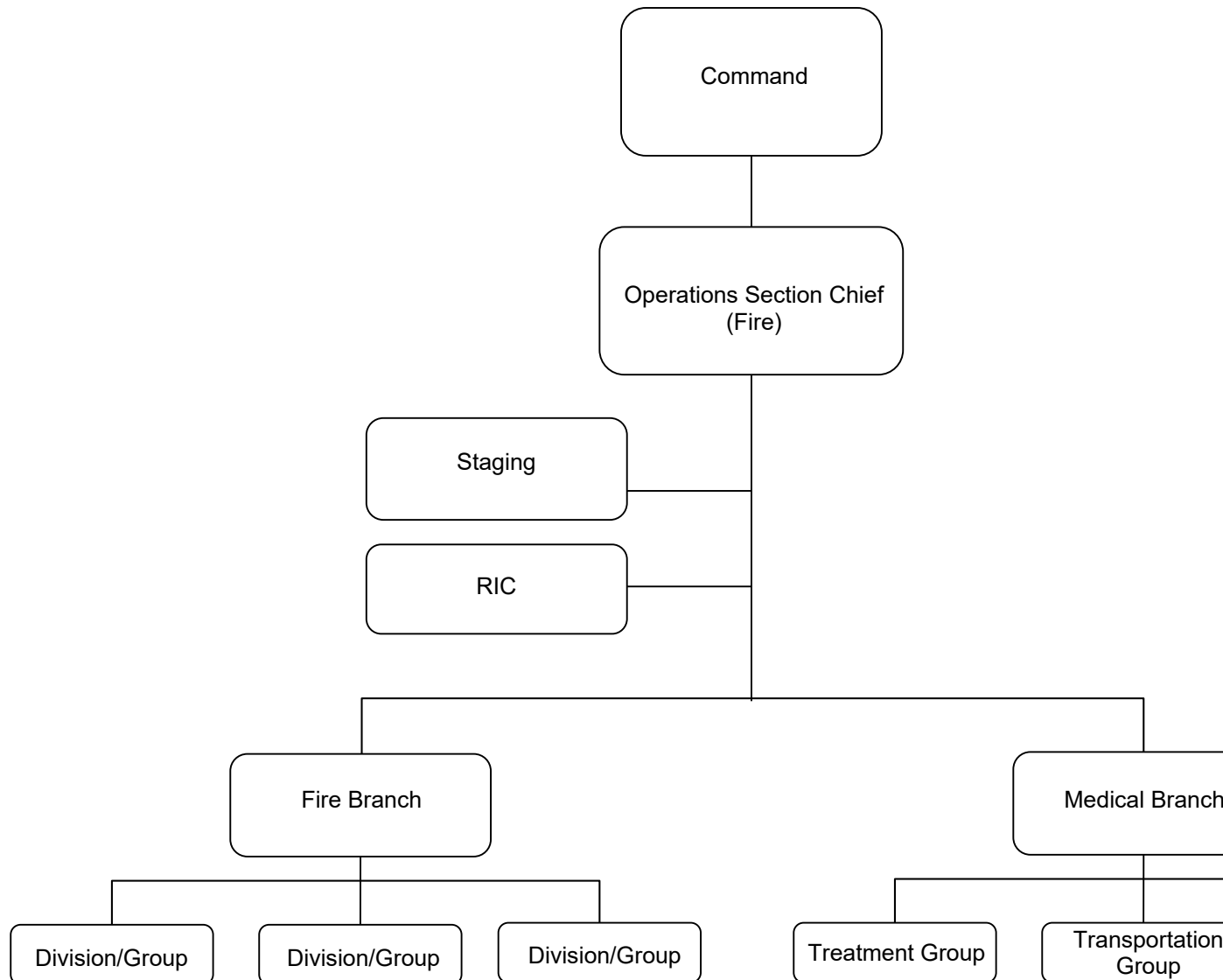
In structural collapse operations, branches should be located at operational locations. When a structural collapse incident encompasses a large geographic area, it is more effective to have branches in tactical locations. When branches are sent to tactical positions, they should immediately implement Command and control procedures within their branch.

Another example of expansion to the branch level may involve a structural collapse with a hazmat problem and a large number of casualties.

### **Functional Branch Structure**

When the nature of the incident calls for a functional branch structure, such as a major structural collapse incident within a jurisdiction, three departments within the jurisdiction (police, fire, and health service) will each have a functional branch operating under the direction of a single OSC. In this example, the OSC is from the fire department, with deputies from police and health services departments. Other alignments could be made, depending upon the jurisdictional plan and the type of emergency. Note that the IC in this situation could be either Single or Unified Command, depending upon the jurisdiction.

### **Functional Branches**



## Multijurisdictional Incidents

**When the incident is multijurisdictional, resources are best managed under the agencies that normally have control over those resources.**

Branches should be used at incidents where the span of control with divisions and groups is maximized, or at incidents involving two or more distinctly different management components (e.g., a large collapse with a major search-and-rescue operation and a large number of patients). The IC may elect to assign branches to forward positions to manage and coordinate activities, as illustrated.

## Air Operations

When the incident requires the use of aircraft, such as for the transportation of victims from a multicasualty incident, highrise rooftop rescue, swift-water rescue, or wildland fire, the OSC

should establish the Air Operations Branch organization. Its size, organization, and use will depend primarily upon the nature of the incident and the availability of aircraft.

## **Command--Single and Unified**

Command is responsible for overall management of the incident. Command also includes certain staff functions. The Command function within the ICS may be conducted in two general ways:

- Single Command; and
- Unified Command.

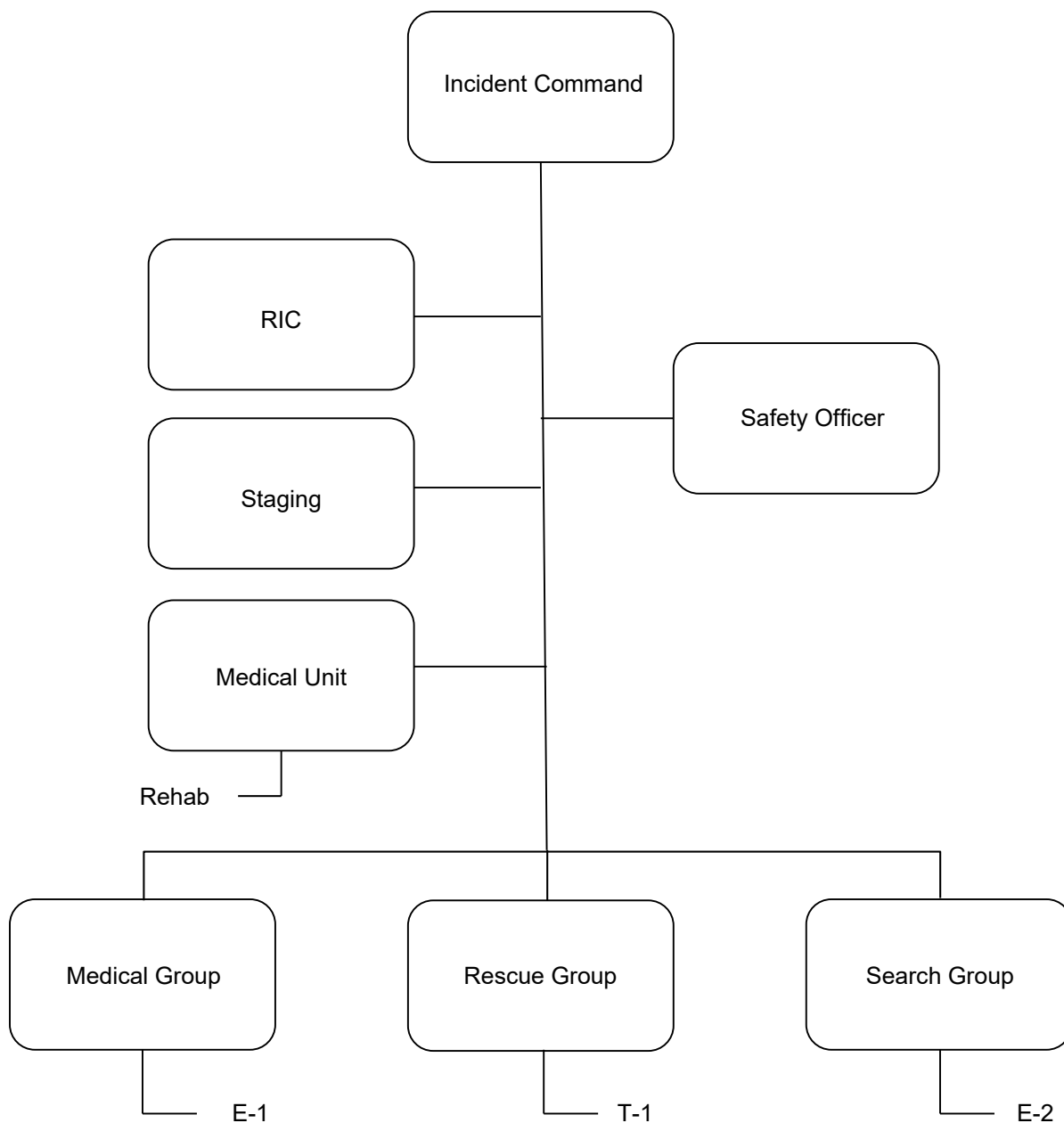
### **Single Command**

Within a jurisdiction in which an incident occurs and where no overlap of jurisdictional boundaries is involved, a single IC is designated by the jurisdictional agency to have overall management responsibility for the incident.

The IC prepares incident objectives that serve as the foundation for subsequent action planning. The IC approves the final action plan and approves all requests for ordering and releasing primary resources. The IC may have a deputy. The deputy should have the same qualifications as the IC. The deputy may work directly with the IC, be a relief IC, or perform certain specific assigned tasks.

At an incident within a single jurisdiction where the nature of the incident is primarily the responsibility of one agency--e.g., fire--the deputy may be from the same agency. In a multiagency or multijurisdictional incident, or one that threatens to become multijurisdictional, the deputy role may be filled by an individual from another agency with a primary responsibility or designated by the adjacent jurisdiction. More than one deputy could be involved. Another way of organizing to meet multiagency or multijurisdictional situations is to use a Unified Command (UC).

This figure depicts an incident with Single Incident Command authority.



### Unified Command

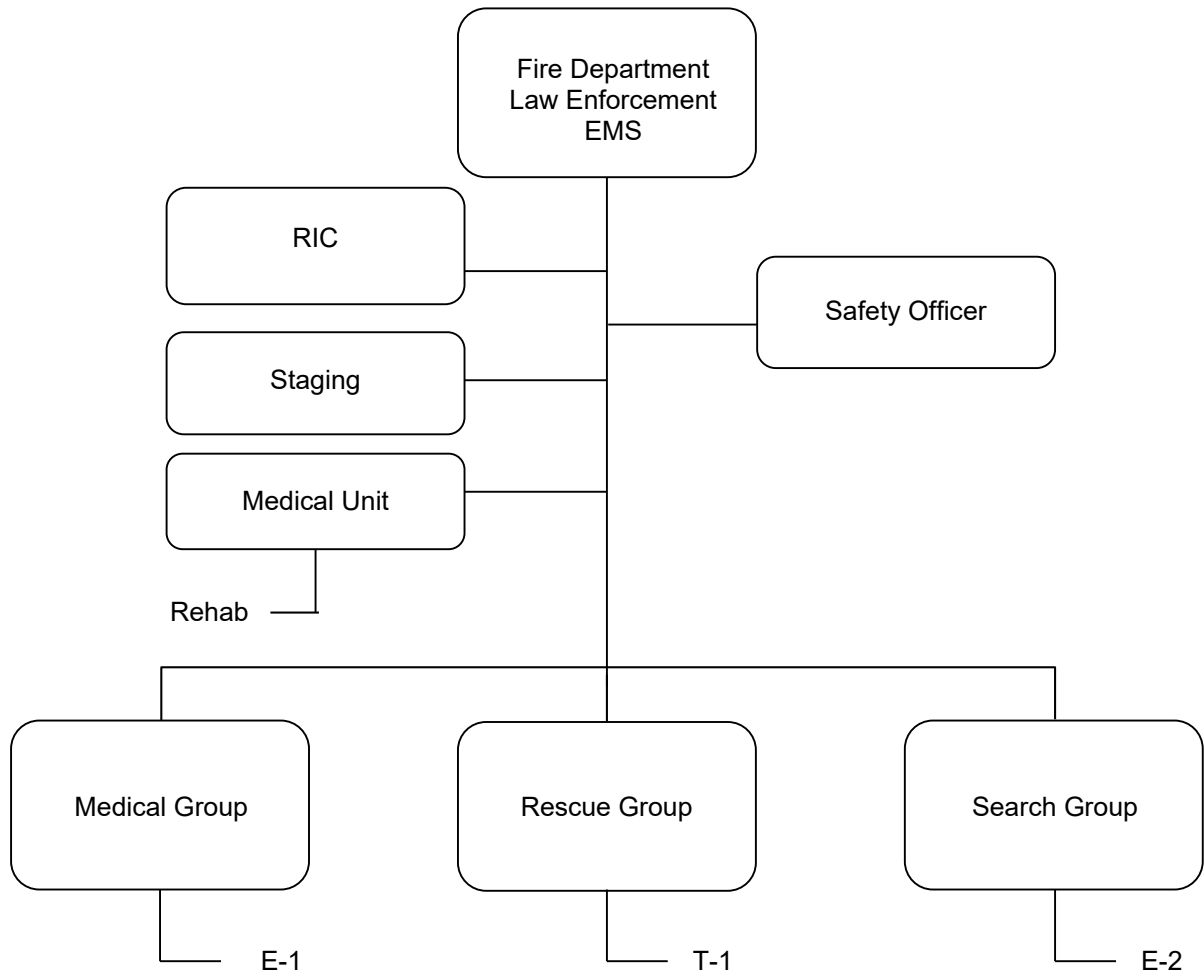
A UC structure is called for under the following conditions:

When the incident is totally contained within a single jurisdiction, but more than one department or agency shares management responsibility due to the nature of the incident or the kinds of resources required (e.g., a World Trade Center-type incident). Fire, medical, and law enforcement all have immediate but diverse objectives. An example of this kind of UC structure is depicted below.

## Unified Command Structure

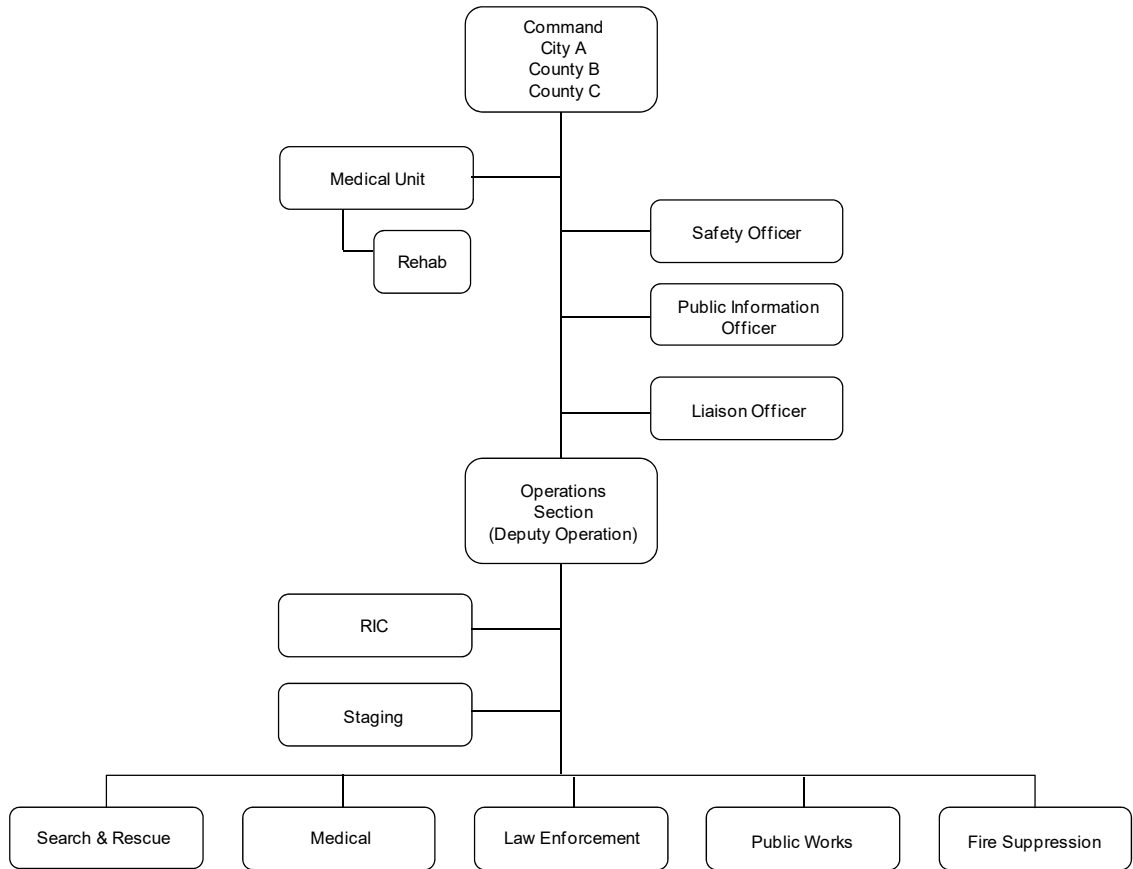
### Multidepartment, Same Jurisdiction

When the incident is multijurisdictional, such as a major earthquake or hurricane. An example of this kind of UC structure is shown on the next page.





## Unified Command Structure Multijurisdictional



### Single/Unified Command Differences

The primary differences between the Single and Unified Command structures are as follows:

- In a Single Command structure, a single IC is solely responsible, within the confines of the IC's authority, to establish objectives and overall management strategy associated with the incident. The IC is directly responsible for followthrough to ensure that all functional-area actions are directed toward accomplishment of the strategy. The implementation of planning required to effect operational control is the responsibility of a single individual (OSC) who reports directly to the IC.
- In a UC structure, the individuals designated by their jurisdictions, or by departments within a single jurisdiction, must jointly determine objectives, strategy, and priorities. As in a Single Command structure, the OSC has responsibility for implementation of the plan. The determination of which agency or department provides the OSC must be made by mutual agreement of the UC. It may be done on the basis of greatest agency or jurisdictional involvement, number of resources involved, existing statutory authority, or consensus opinion concerning the individual's qualifications.

## **Differences between National Incident Management System and Fire RESources of California Organized for Potential Emergencies Incident Command System**

The Information Officer position is called the Public Information Officer (PIO).

The Intelligence and Investigation function may be organized in one of the following ways:

- officer within the Command Staff;
- unit within the Planning Section;
- branch within the Operations Section; and
- separate General Staff Section.

## **Intelligence and Investigation Options in the National Incident Management System**

### **As an Officer in the Command Staff**

This option may be most appropriate in incidents with little need for tactical or classified intelligence and in which incident-related intelligence is provided by supporting agency representatives through real-time reach-back capabilities.

### **As a Unit within the Planning Section**

This option may be most appropriate in incidents with some need for tactical intelligence and in which no law enforcement entity is a member of the UC.

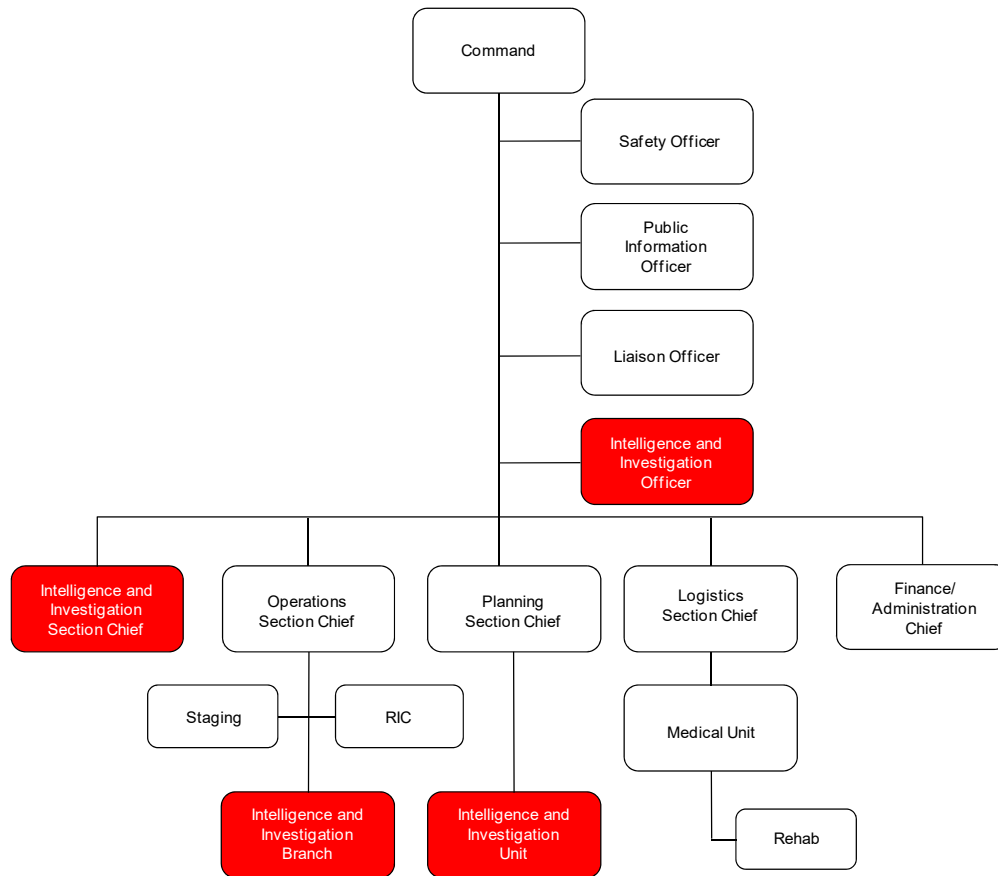
### **As a Branch within the Operations Section**

This option may be most appropriate in incidents with a high need for tactical intelligence (particularly classified intelligence) and in which law enforcement is a member of the UC.

### **As a General Staff Section**

This option may be most appropriate when an incident is heavily influenced by intelligence factors.

- It is also appropriate when there is a need to manage and/or analyze a large volume of classified or highly sensitive intelligence or information.
- This option is particularly relevant to a terrorism incident, for which intelligence plays a crucial role throughout the incident life cycle.



### Intelligence and Investigation Options in the National Incident Management System--Summary

- Regardless of how it is organized, the Intelligence and Investigation function is also responsible for developing, conducting, and managing information-related security plans and operations as directed by the IC.
- These can include information security and operational security activities, as well as the complex task of ensuring that sensitive information of all types (e.g., classified information, sensitive law enforcement information, proprietary and personal information, or export-controlled information) is handled in a way that not only safeguards the information but also ensures that it gets to those who need access to it so that they can effectively and safely conduct their missions.
- The Intelligence and Investigation function also has the responsibility for coordinating information- and operational-security matters with public awareness activities that fall under the responsibility of the PIO, particularly where such public awareness activities may affect information or operations security.

# NOTETAKING GUIDE



## NOTE-TAKING GUIDE

Slide 2-1

**Unit 2:**  
**The Incident Command**  
**System Organizational**  
**Structure**

Slide 2-1

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Slide 2-2

**Terminal Objective**

The students will be able to explain basic Command procedures and the Incident Command System (ICS) organizational structure.

Slide 2-2

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Slide 2-3

**Enabling Objectives**

The students will:

- Identify the functions of an Incident Commander (IC).
- Describe operational elements within the Command structure.

Slide 2-3

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Slide 2-4

### Incident Command System Functions

Primary functions include

- Command
- Planning
- Operations
- Logistics
- Finance/Administration

Slide 2-4

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Slide 2-5

### Commander

Command responsibilities are to:

- Assess the incident (sizeup)
- Develop an Incident Action Plan (IAP)
- Organize Incident Management Team (IMT) and response
- Request and deploy resources
- Manage the incident
- Provide for safety
- Assume overall responsibility at the incident

Slide 2-5

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Slide 2-6

### Command

Is responsible for developing a plan that includes

- Setting objectives
- Establishing strategies
- Assigning resources
- A Command organization

Slide 2-6

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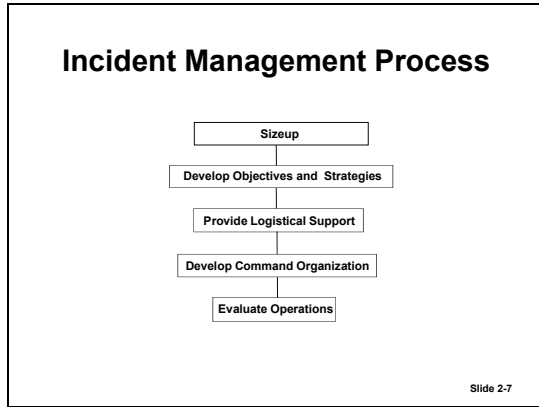
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Slide 2-7



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Slide 2-8

**Incident Commander**

The IC will:

- Concentrate on the "big picture"
- Concentrate on strategic plans of the entire incident
- Manage Command and General Staff positions

Slide 2-8

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Slide 2-9

**Incident Commander (cont'd)**

IC responsibilities include

- Reviewing, evaluating, planning, and initiating changes
- Providing ongoing review of overall incident
- Directing Command and General Staff positions
- Reviewing the organizational structure
- Staffing Command and General Staff functions
- Establishing liaison with internal and external agencies, owners, and tenants

Slide 2-9

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Slide 2-10

### Incident Commander (cont'd)

The IC is responsible for each of the following functions:

- Operations
- Planning
- Logistics
- Finance/Administration

Slide 2-10

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Slide 2-11

### General Staff--Section Chiefs

- As the incident escalates, additional support is required.
- The IC can become overwhelmed quickly.
- Arriving personnel fill Command and General Staff positions.
- Staff these positions only as needed.

Slide 2-11

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Slide 2-12

### Operations Section Chief

- Responsible for direct management of all tactical activities and priorities and personnel safety and welfare
- Often staffed due to span-of-control problems at the IC level
- Staffed when the IC cannot be involved in tactics without losing the "big picture"

Slide 2-12

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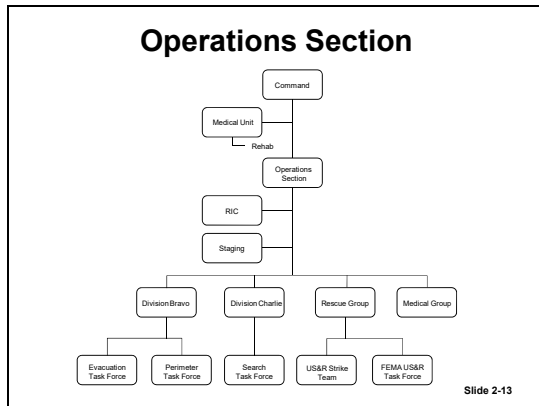
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Slide 2-13



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Slide 2-14

**Staging Area**

- Located within the incident area.
- Temporary location for immediately available resources.
- Established early in the incident.
- Run by an assigned Staging Area Manager.
- During an expanded incident, Staging reports to Operations (if established).
- All resources in Staging are controlled directly by Operations.

Slide 2-14

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Slide 2-15

**Planning Section**

**Responsibilities include**

- Gathering information
- Analyzing information
- Processing information
- Developing an IAP
- Maintaining situation and resource status

Slide 2-15

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Slide 2-16

**Planning Section Chief**

- Information management is a full-time job.
- Planning Section Chief (PSC) serves as the IC's information clearinghouse.
- Critical information is forwarded directly to the IC.
- Long-term plans are needed for complex operations.

Slide 2-16

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Slide 2-17

**Planning Section Chief (cont'd)**

The PSC's goals:

- Plan ahead
- Identify projected resources

Slide 2-17

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Slide 2-18

**Planning Section Chief (cont'd)**

Responsibilities include

- Evaluating current strategy/planning with the IC
- Maintaining Resource Status (RESTAT)
- Recommending changes to the IAP
- Evaluating incident organization and span of control
- Forecasting possible outcomes
- Using technical assistance

Slide 2-18

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Slide 2-19

### **Planning Section Chief (cont'd)**

**Responsibilities include**

- Evaluating tactical priorities, specific critical factors, and safety
- Gathering, updating, improving, and managing situation status
- Coordinating planning needs with outside agencies
- Planning for demobilization
- Maintaining incident records

Slide 2-19

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Slide 2-20

### **Victim Locator Unit**

- Reports to PSC
- Functions as a (situational) intelligence-gathering unit
- Interviews
  - Witnesses
  - Occupants
  - Neighbors
  - Injured victims

Slide 2-20

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Slide 2-21

### **Logistics Section Chief**

- The support mechanism for the organization.
- Logistics support may be very complex. Complexity is based on:
  - Amount and type of specialized resources assigned.
  - Duration of incident.

Slide 2-21

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Slide 2-22

### Logistics Section Services

Services and support functions include

- Command Post (CP), base, and other facilities
- Transportation/Traffic plan
- Supplies
- Equipment maintenance
- Fueling
- Feeding
- Communications
- Responder Medical Unit/rehabilitation

Slide 2-22

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Slide 2-23

### Logistics Section Chief

Responsibilities include

- Establishing Medical Unit/responder rehab (for response personnel)
- Coordinating immediate Critical Incident Stress Management (CISM)
- Providing and managing supplies and equipment
- Forecasting and obtaining future resource needs
- Providing communications plan and equipment

Slide 2-23

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Slide 2-24

### Logistics Section Chief (cont'd)

Responsibilities include

- Providing fuel and equipment repairs
- Obtaining specialized equipment/expertise
- Providing food and associated supplies
- Securing needed (fixed or portable) facilities
- Meeting any logistical needs of the IC

Slide 2-24

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Slide 2-25

**Finance/Administration  
Section Chief**

Responsibilities include

- Procuring services and supplies
- Documenting all financial costs
- Documenting for recovery of services and supplies
- Documenting compensation and claims for injuries
- Obtaining all documentation for cost recovery
- Handling all legal requirements

Slide 2-25

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Slide 2-26

**Command Staff**

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graph TD; IC[Incident Commander] --- PIO[Public Information Officer]; IC --- SO[Safety Officer]; IC --- LO[Liaison Officer];
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Slide 2-26

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Slide 2-27

**Public Information Officer**

Develops and maintains informational briefings covering details such as:

- Incident cause
- Incident size
- Current situation
- Resources committed
- Other matters of general interest

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Slide 2-28

**Public Information Officer (cont'd)**

**Responsibilities include**

- Establishing media point of contact and Joint Information Center (JIC), if appropriate
- Addressing the media (at frequent briefings)
- Providing a "media area" (away from the CP)
- Requesting assistance (as required)
- Providing photo opportunities for the media

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**Safety Officer**

**Responsibilities include**

- Assessing hazards and unsafe conditions
- Developing measures for ensuring personnel safety
- Stopping (or preventing) unsafe acts
- Assigning Assistant Safety Officers (SOs) who have structural collapse training
- Ensuring that responder Medical Unit/rehabilitation is established

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**Liaison Officer**

**Responsibilities include**

- Acting as a point of contact for representatives from other agencies.
- Representatives from outside agencies must have authority to speak on behalf of their agencies.

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Slide 2-31

**Establishing Command**

- First fire department member to arrive at the scene assumes Command.
- The IC remains in Command until Command is transferred or until the incident is stabilized.
- The response of additional ranking officers strengthens the Command function.

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Slide 2-32

**Passing Command**

- Should be limited to verified rescues or when immediate intervention would mitigate the problem
- Usually accomplished onscene by radio

Slide 2-32

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Slide 2-33

**Transfer of Command**

- Command is transferred to improve the quality and effectiveness of the Command organization.
- Transfer of Command may be predetermined by local departments.

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Slide 2-34

### Transfer of Command Process

- First-arriving fire department Company Officer (CO) assumes Command.
- First-arriving chief officer may assume Command (using Transfer of Command guidelines).
- Second-arriving chief officer reports to CP for assignment.
- Later-arriving chief officers may assume Command or perform other duties.

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Slide 2-35

### Transferring Command

#### Guidelines:

- Officer assuming Command should do a sizeup prior to Transfer of Command.
- Member being relieved briefs the officer assuming Command.
- Officer relieved is reassigned.

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### Command Objectives

#### Responsibilities include

- Assessing the situation (sizeup)
- Establishing overall objectives
- Setting priorities
- Developing IAP
- Obtaining and assigning resources
- Evaluating progress, predicting outcomes, and planning
- Assigning SMART objectives

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Slide 2-37

### SMART Objectives

**S--Specific**  
**M--Measurable**  
**A--Action-Oriented**  
**R--Reasonable**  
**T--Time**

Slide 2-37

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Slide 2-38

### Command Strategies

**Responsibilities:**

- Directs operational activities toward specific objectives.
  - This level includes branch directors and division and group supervisors responsible for geographic areas or functions.
- Develops strategies to accomplish objectives outlined in the IAP.

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Slide 2-39

### Tactics

- Activities accomplished by supervisors assigned to strategic positions
- Constitute level at which work is actually performed
- Normally supervised by COs
- Accomplish Command strategies

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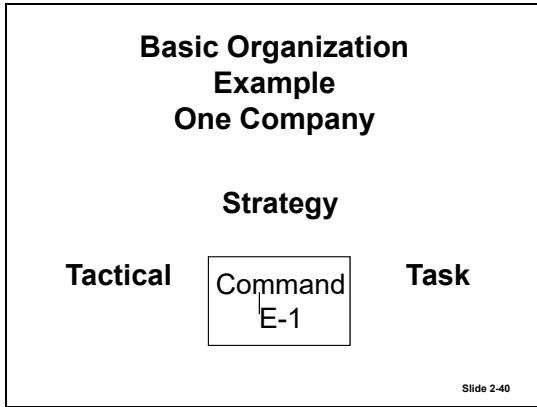
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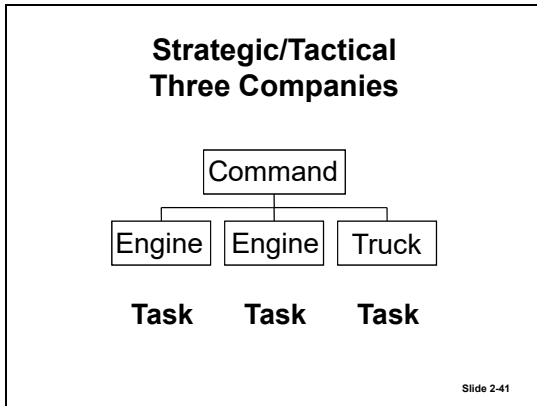
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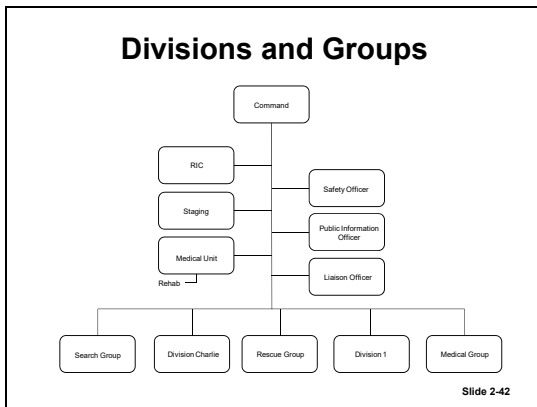
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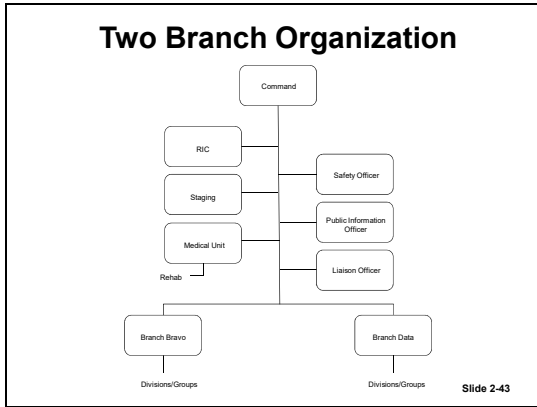
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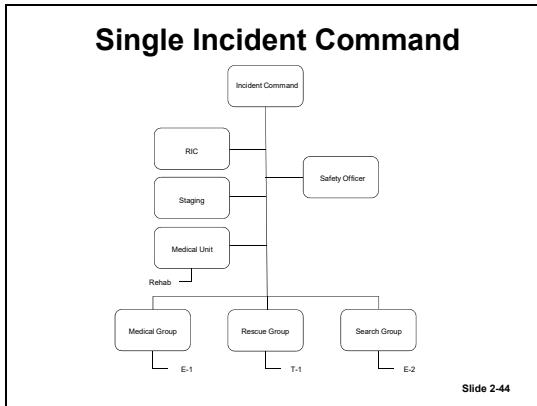
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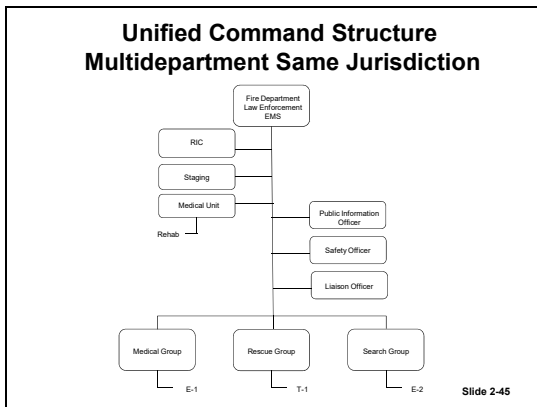
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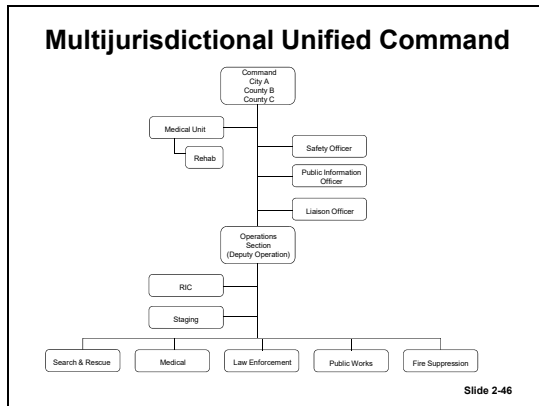
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Slide 2-46



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Slide 2-47

**National Incident Management System/National Response Framework**

Differences between National Incident Management System (NIMS) and Fire REsources of California Organized for Potential Emergencies (FIREScope) ICS

- Information Officer position called the Public Information Officer (PIO)
- Addition of the Information and Intelligence function

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Slide 2-48

**ADDITIONAL INFORMATION NATIONAL INCIDENT MANAGEMENT SYSTEM/ NATIONAL RESPONSE FRAMEWORK**

- First responder DHS training requirement
- Factsheet
- Video

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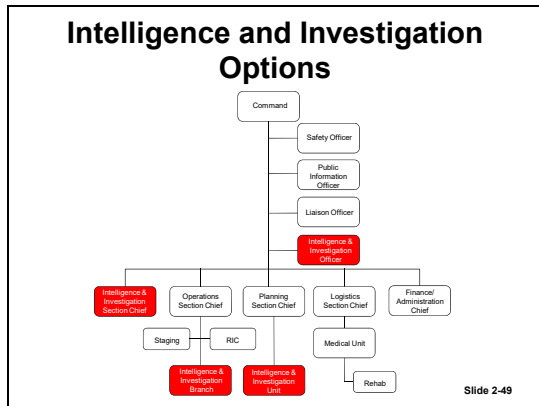
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Slide 2-50

### Summary

- ICS functions are used, although specific positions may not be filled.
- The IC is responsible for sizeup, setting objectives and strategies, requesting and deploying resources, organizing, and incident management.
- ICS Command and General Staff positions are activated as needed.

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Slide 2-51

### Summary (cont'd)

- First-arriving fire department member establishes ICS and takes all initial actions.
- Transfer of Command improves effectiveness.
- The IC is responsible for developing the organization based on the needs of the incident.
- The three levels of Command are strategic, tactical, and task.

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Slide 2-52

**Summary (cont'd)**

- The basic Command organization may be expanded using divisions, groups, and branches.
- Command may be single or unified when needed for multiagency or multijurisdictional incidents.

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## ***UNIT 3: RESPONSE RESOURCE CAPABILITIES***

### ***TERMINAL OBJECTIVE***

*The students will be able to identify various resource levels, types, and capabilities used for structural collapse incidents.*

### ***ENABLING OBJECTIVES***

*The students will:*

- 1. Define the types and levels of structural collapse risks within a jurisdiction.*
  - 2. Define various levels of capability for a structural collapse incident.*
  - 3. Describe resources available through local, State, and Federal agencies.*
-





## **INTRODUCTION**

The Incident Commander (IC) at a structural collapse incident must be able to identify the type of collapse that has occurred and the hazards to rescuers and victims, and be able to match the appropriate level of rescue capability with the problem.

There are many levels of capability, including spontaneous volunteers, standard fire companies, heavy-rescue squads, technical rescue teams (e.g., confined space and Federal Emergency Management Agency (FEMA) National Urban Search and Rescue (US&R) Task Forces). There are many agencies that may respond to a structural collapse. This type of incident is normally a multiagency response because of the many tasks that must be accomplished (e.g., medical, law enforcement, heavy equipment resources, etc.).

Structural collapse resources may be available from:

- local jurisdictions;
- State and Federal governments;
- members of the private sector; and
- trained civilian volunteers.

## **Government Levels of Response**

### **Local Level**

This includes trained volunteers, standard fire companies, fire companies with specialized equipment, technical rescue, and heavy-rescue teams or companies.

### **Regional Level**

This provides access to resources from surrounding jurisdictions through mutual aid or contract.

### **State Level**

These resources may include specialized teams, equipment, task forces, and the National Guard.

### **Federal Level**

This includes FEMA US&R Task Forces, FEMA incident support teams (ISTs), the military, and many other supporting agencies. (There are 28 FEMA Task Forces.)

### **International Level**

This response may involve search-and-rescue teams of varying capabilities from other countries.

The IC must know what resources are needed and how to manage and coordinate those resources.

## **RISK/HAZARD ANALYSIS**

The fire service has a key role in collapsed structure response and should have the capability to respond effectively to the various types of incidents encountered. The question is, "What type of capability is needed in each community?" This question may be answered by performing a risk/hazard analysis.

Many departments form technical rescue teams after a specific rescue incident has shown a deficiency or inability to handle the rescue safely and effectively. In some cases, a team is developed before a major rescue incident occurs, due to the expectation of emergencies created by risks in the community.

In determining whether a team is needed in your community, you must first do some research to evaluate the risks in your area. A risk analysis helps you to determine the level of risk and potential hazards so that you can decide whether a team is really needed. This is particularly important for two reasons. First, political leaders want to know what risks exist to justify funding a team. Second, you want to know what risks confront your department, what type of hazardous scenarios to train for, and what rescue equipment is needed to address the risks. A thorough risk analysis should define your objectives and justify the effort of forming a team.

### **Risk/Hazard Analysis Elements**

A risk/hazard analysis involves the following elements.

#### **Performing a Risk Assessment**

A risk assessment is based on historical data plus an analysis of newly introduced hazards and potentially high-risk problems. Begin by assessing past rescue needs in your response area. You may look at incident reports to determine frequency, incident type, and location. Other potential sources of data include your State workers' compensation office, State and national Occupational Safety and Health Administration (OSHA) offices, construction and contractors' associations, building officials and inspectors, and safety managers at local businesses. Past experience may indicate the likelihood of technical rescue-type incidents during major construction projects.

Regardless of the size or economic makeup of the community, almost every jurisdiction is subject to some kind of risk.

#### **Considering Target Hazards**

A department faces specific risks each day. You must also consider target hazards in your response area, or those you anticipate in the future. Target hazards are specific risk areas that confront your department in a rescue emergency that have a high potential for life loss or injury.

Make a list of target hazards that present special rescue challenges requiring special training and equipment to control safely and effectively.

A hazard analysis may be used to assist in the development of findings and conclusions using a scoring system based on four criteria:

1. History.
2. Vulnerability.
3. Maximum threat.
4. Probability.

### History

The history or the record of previous emergencies is important in hazard analysis. A past record of incidents indicates a predisposition for the same kinds of problems to arise in the future. Unless the specific conditions that led to the problem no longer exist, or have been substantially reduced or mitigated, similar emergencies may happen again.

### Vulnerability

Vulnerability includes all persons who may be killed, injured, or contaminated by an incident and all property that may be destroyed, damaged, or contaminated. Determining the number of people and the value of property in jeopardy gives useful information for assessing vulnerability. Vital facilities and population groups of special concern can be identified in vulnerability descriptions. For example, powerplants, hospitals, the aged, the handicapped, children, etc.

### Maximum Threat

Maximum threat is the worst-case scenario of a hazard. In determining this factor, assume both the greatest event possible and the greatest impact (e.g., a maximum credible earthquake in an urban center on a weekday during business hours. This may also involve secondary threats such as hazmat problems, etc.).

### Probability

Probability is the likelihood that an event will occur. It can be expressed as the odds that an incident may occur during a given period of time; for example, the odds are 1 in 100 that the particular event will occur in any given year. There is a correlation between historic data and probability; however, recent development of new hazardous conditions in a community may increase the probability over what would be indicated by history alone.

## Rating System

A numbered weight or percentage may be given to each criterion, and a rating of low, medium, or high may be assigned to each criterion for each hazard.

The list of hazards can be ranked by the product of the criterion weights and ratings. The highest-ranking hazards should receive highest-priority consideration.

## Analyzing Data

The likelihood of a technical rescue emergency is projected by developing a frequency rate. To demonstrate the likelihood of a technical rescue incident, the frequency and incident type must be shown over a given period of time in the community involved or in adjacent communities with similar problems. A "potential" collapse incident and associated hazards must be weighted heavily in the analysis.

For example, confined-space incidents may be projected in the future by estimating the number of confined spaces in future years, and then multiplying this by the current rate of incidents per confined space.

## Establishing a Risk Threshold

Performing a risk/benefit analysis reflects response capability for equipment and trained personnel. It is the final determination in weighing the potential risk to the community and the potential risk to emergency responders. Each community must define an "acceptable" level of risk and must define the threshold that necessitates the formation of a special rescue team. The community and city administrators should know exactly what the fire department's rescue capabilities and limitations are, what risks confront the community, and what dangers rescuers face in performing rescues.

## Determining the Type of Team (or Capability) Needed to Respond

The risk analysis should help in determining whether a team is needed. The next step is to determine the kind of team for the particular type of hazard. Will the team handle only basic rescue or will it be expected to perform complex rescues? The level of required capability must be developed. The response capability may come from within the jurisdiction, from a single agency or multiple agencies, or from mutual aid or contract from other jurisdictions or agencies in the region. Response time is a critical consideration in this assessment.

## **Follow-up To the Risk/Benefit Analysis Process**

After the community risk/benefit analysis is completed, the planning process begins with developing a plan for implementation and obtaining funding support. Next, developing the team,

training, equipment, vehicles, a continuing education and maintenance program, and standard operating guidelines (SOGs) are required.

## **LEVELS OF OPERATIONAL CAPABILITY**

Operational capability refers to different types of operations and resource deployment. They are defined in the National Fire Protection Association (NFPA) Standard 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*. This Standard establishes levels of operational capability based on the degree of hazard and jurisdictional risk assessment, the training level of personnel, and the availability of resources. Additional information can be obtained in NFPA 1006, *Standard for Technical Rescuer Professional Qualifications*, and NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*.

Today, most fire departments would be able to perform at the basic and light operational levels and many at the medium level of capability. Departments need to determine their level of capability using this Standard as a guide.

Levels of operational capability should be established within each jurisdiction to conduct search-and-rescue operations safely and effectively.

Established levels are based on hazard and risk assessment, the training level of personnel, and the availability of internal and external resources.

### **Basic Operational Level**

The basic level represents the minimum capability to conduct safe and effective search-and-rescue operations at noncollapse incidents. Personnel at this level shall be competent at surface rescue that involves minimal removal of debris and building contents to extricate easily accessible victims from uncollapsed structures.

### **Light Operational Level**

The light level represents the minimum capability to conduct safe and effective search-and-rescue operations at structural collapse incidents involving the collapse or failure of light-frame construction, and basic rope rescue operations.

### **Medium Operational Level**

The medium level represents the minimum capability to conduct safe and effective search-and-rescue operations at structural collapse incidents involving the collapse or failure of reinforced and unreinforced masonry (URM), concrete tilt-up, and heavy-timber construction.

## **Heavy Operational Level**

The heavy level represents the minimum capability to conduct safe and effective search-and-rescue operations at structural collapse incidents involving the collapse or failure of reinforced concrete or steel-frame construction, and confined-space rescue operations.

Equipment lists for each of these four operational capabilities are provided in the Appendix of this manual.

## **Four Levels of Operational Capability--Minimum Training**

### **Basic Operational Level**

The basic operational level represents the minimum capability to operate safely and effectively at noncollapse incidents. Personnel at this level shall be competent at surface rescue and rescue involving minimal removal of debris and building contents to extricate easily-accessible victims from uncollapsed structures. Rescue operations would include removal of victims from under furniture, appliances, and the surface of a debris pile.

### **Light Operational Level**

Personnel shall meet all basic-level training requirements. In addition, personnel shall be trained in hazard recognition, equipment use, and techniques required to operate safely and effectively at structural collapse incidents involving the collapse or failure of light-frame construction, and basic rope rescue as specified below.

Personnel shall be trained to recognize the unique hazards associated with the collapse or failure of light-frame construction. Training should include, but not be limited to, the following:

- Recognition of the building materials and structural components associated with light-frame construction.
- Recognition of unstable collapse and failure zones of light-frame ordinary construction.
- Recognition of collapse patterns and probable victim locations associated with light-frame construction.

Personnel shall have a working knowledge of the resources and procedures for performing search operations intended to locate victims who are not readily visible and who are trapped inside and beneath debris of light-frame construction. Training should include, but not be limited to, the following:

- Types of search resources: US&R dogs, optical instruments (search cameras), seismic/acoustic instruments (listening devices).

- Capabilities of search resources.
- Acquisition of search resources.

Personnel shall be trained in the procedures for performing access operations intended to reach victims trapped inside and beneath debris associated with light-frame construction. Training should include, but not be limited to, the following:

- Lifting techniques to lift structural components (walls, floors, or roofs) safely and efficiently.
- Shoring techniques to construct safe and efficient temporary structures needed to stabilize and support structural components to prevent movement of walls, floors, or roofs.
- Breaching techniques to create openings in structural components of walls, floors, or roofs safely and efficiently.
- Operating appropriate tools and equipment to accomplish the above tasks safely and efficiently.

Personnel shall be trained in the procedures for performing extrication operations involving packaging, treating, and removing victims trapped inside and beneath debris associated with light-frame construction. Training should include, but not be limited to, the following:

- Packaging victims within confined areas.
- Removing victims from elevated or below-grade areas.
- Providing initial medical treatment to victims to the Basic Life Support (BLS) level at a minimum.
- Operating appropriate tools and equipment to accomplish the above tasks safely and efficiently.

### Medium Operational Level

Personnel shall meet all light-level training requirements. In addition, personnel shall be trained in hazard recognition, equipment use, and techniques required to operate safely and effectively at structural collapse incidents involving the collapse or failure of reinforced and URM, concrete tilt-up, and heavy-timber construction.



### Heavy Operational Level

Personnel shall meet all medium-level training requirements. In addition, personnel shall be trained in hazard recognition, the equipment to use, and the techniques required to operate safely and effectively at structural collapse incidents involving the collapse or failure of reinforced concrete or steel-frame construction, and confined-space rescue.

## **RESCUE SKILLS**

Generally, rescue skills needed or performed in structural collapse incidents correspond to the type of victim entrapment.

- About 50 percent of injured victims (not trapped) are rescued by spontaneous volunteer rescuers.
- About 30 percent of victims in nonstructural and light entrapment may be rescued by trained community teams (Community Emergency Response Teams (CERTs)).
- About 15 percent of victims entrapped in structural collapse void spaces are rescued by emergency service providers.
- About 5 percent of victims entombed in a structural collapse are rescued by specialized heavy-rescue teams.

Emergency responders must be able to control spontaneous volunteers who may be working at the scene upon the arrival of the emergency responders.

Supervising volunteers involves ensuring that certain basic procedures are followed:

- The incident or each situation is isolated.
- All information is evaluated.
- Tasks are delegated.
- Needs are communicated.

The safety of the volunteer workers is of primary importance, and should not be compromised.

## **NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 1670**

NFPA 1670 pertains to levels of functional capability for conducting operations safely and effectively at technical rescue incidents, including structural collapse. Standards for levels of proficiency have been developed, ranging from awareness to operations to technician. Each level has increasing operational requirements and functions.

## **RESCUE RESOURCES**

### **Introduction**

Fire departments across the United States have assumed a major role as primary responders to rescue incidents that involve, among other things, structural collapse, trench cave-ins, confined spaces, industrial and agricultural machinery, water emergencies, and people trapped above- or below-grade level. These emergencies are grouped into a category called technical rescue. Technical rescue incidents are often complex, requiring specially trained personnel and special equipment to complete the mission. Natural forces such as earthquakes, rain, temperature extremes, and swift water currents often complicate technical rescue incidents. The presence of flammable vapors and toxic chemicals can also increase the level of risk. The safety of crews conducting technical rescue operations is of special concern.

Fire and rescue departments throughout the country perform technical rescues on a daily basis. Some complex technical rescue incidents last many hours or even days, as rescue personnel assess the situation carefully, obtain and set up the appropriate rescue equipment, monitor scene safety, and remove hazards before they can finally reach, stabilize, and extricate the victims. The presence of hazards such as flammable vapors or dust often force rescuers to take additional precautions and time to ensure that operations are conducted safely. Experience has shown that hasty rescue operations can endanger the lives of both rescuers and victims. At the same time, rescuers know that a victim's survival chances often depend on quick extrication and transportation to a hospital.

Some departments are better prepared than others to perform technical rescue operations. To deal with these complicated rescue operations, many fire departments have created special technical rescue teams. A technical rescue team is a specialized group of personnel having advanced training and special equipment to conduct specialized rescue operations safely and efficiently. The specialties and capabilities of individual teams vary greatly, depending on their level of training, number of trained personnel, and availability of specialized rescue tools and equipment. For example, some departments have the training and equipment to perform rescues at collapsed structures by cutting through concrete and removing heavy debris, while other departments are limited to working with picks and shovels to remove debris.

Many departments have single-discipline rescue teams, for example, a trench rescue team. These teams are trained and equipped to handle one type of rescue. Other departments have multidiscipline teams that are prepared to perform more than one type of rescue.

The formation of a technical rescue team, whether single-discipline or multidiscipline, requires careful planning, a long time commitment from the team members, equipment research and acquisition, risk analysis, training, and funding.

## **Technical Rescue Capabilities**

### **Confined-Space Rescue**

A confined space is an enclosed area with limited entry or egress, which has an internal configuration not designed for human occupancy, such that an entrant could become trapped or asphyxiated. It may have inwardly converging walls, or a floor that slopes downward and tapers to a smaller cross-section. These spaces include sewers, vats, caves, tanks, and other areas. Rescues from such spaces are dangerous, especially if the interior environment is toxic or oxygen-deficient. OSHA terms these dangerous areas "permit-required confined spaces." OSHA estimates that there are over 240,000 such permit-required spaces across the United States.

### **Collapse Rescue**

Collapse rescue involves building collapse or other structural collapse, such as the collapse of various buildings in the 1994 Northridge, California earthquake or the collapse of the elevated highway in Oakland, California during the 1989 Loma Prieta earthquake. Many collapse-rescue teams have been established in earthquake-prone areas. A collapse-rescue capability is a necessity in most parts of the country, with both natural and human-caused collapses occurring with regularity. Recent disasters and acts of terrorism such as the 1995 Oklahoma City bombing and the September 11, 2001, attacks on New York and the Pentagon have increased the need for heavy-rescue capability.

### **Trench/Cave-In Rescue**

Trench or cave-in rescue can occur in almost any jurisdiction across the country. Trenches are often found in areas of new construction, where pipes or cables are being buried or excavated for new construction footing and foundation work. The most common trench-rescue scenario involves rescuing a construction worker trapped when the trench walls collapse.

### **Rope Rescue**

High-angle or low-angle rescues occur around cliffs, ravines, caves, mountainous areas, or highrise buildings, communication towers, water towers, or silos. These rescues may require complex rope and hauling systems to secure personnel and extricate victims safely.

### **Industrial Rescue**

Industrial machinery presents many challenges to rescuers. Many industrial rescues involve confined spaces or heavy-rescue extrication to free victims trapped by machinery.

## **Structural Collapse Resources**

Many different kinds of resources from both the government and the private sector are available for response to structural collapses.

- local jurisdictions;
- local and State governments;
- Federal governments (FEMA);
- members of the private sector;
- trained civilian volunteers;
- State US&R Task Forces; and
- FEMA US&R Task Forces.

Each resource may have varying capabilities and functions for the broad scope of search-and-rescue requirements. The key to effective resource use is to match the right resource to the job. This becomes problematic when dealing with difficult rescue situations where a very high level of capability is needed, because of the scarcity of these resources throughout the country.

## **Government Levels of Response**

Government response can occur at the following levels:

- local;
- regional;
- State;
- Federal; and
- international.

Government resources may consist of fire department engine, truck, and heavy-rescue companies; specialized US&R companies and squads; confined-space teams; high-angle rescue teams; technical rescue teams; canine search teams; technical search teams; State and FEMA US&R task forces; and specialized medical teams. Most of these resources come from the fire service, but other agencies (such as public works departments and law enforcement) may also have such specialized resources to offer.

Support resources may include hazmat teams, emergency medical services (EMS) responders, public works departments, law enforcement, the military, the Army Corps of Engineers, and technical specialists such as structural engineers.

## The National Urban Search and Rescue System

The National US&R Response System, established under the authority of FEMA in 1989, is a framework for structuring local emergency services personnel into integrated disaster response task forces. These task forces, complete with the necessary tools and equipment and skills and techniques, can be deployed by FEMA to rescue victims of structural collapse.

When the Federal government mobilizes resources and conducts activities to support State and local response efforts to disasters, it does so under 12 Emergency Support Functions (ESFs). Each ESF is led by a primary agency which has been selected based on its authorities, resources, and capabilities in a particular functional area. FEMA is the primary agency for ESF #9, US&R.

After a request for Federal assistance from a governor is received and approved by the President, task forces may be activated or placed on alert to respond to a major disaster. The alerted task forces start locating personnel and organizing their mobilization. Each task force can be airborne and heading to its destination in a matter of hours.

Currently, there are 28 FEMA US&R Task Forces spread throughout the continental United States. These task forces are trained and equipped by FEMA to handle structural collapse, and they encompass local emergency service personnel from 18 States. Any operational task force can be deployed by FEMA to a major disaster to provide assistance with structural rescue. Two task forces have also responded to several international disasters under the auspices of the U.S. Agency for International Development, Office of Foreign Disaster Assistance.

A FEMA US&R Task Force is comprised of 72 specialists and is divided into four major functional elements:

1. Search.
2. Rescue.
3. Technical.
4. Medical.

Task force members include structural engineers and specialists in the areas of hazardous materials, heavy rigging, search (including highly-trained search dogs), logistics, rescue, and medicine. By design, there are two task force members assigned to each position, to allow rotation and relief of personnel during round-the-clock task force operations.

Each task force is supported by a comprehensive equipment cache weighing in total over 58,000 pounds. The cache elements sent to the disaster scene include communications, locating devices, rope, rigging, hauling, lifting, and pulling equipment. Shoring, structural movement sensing, victim extrication, cutting, and drilling devices are included to perform the often-difficult assignments encountered by a FEMA US&R Task Force.

The medical team is comprised of four medical specialists and two physicians. Many of the medical specialists on US&R teams are both paramedics and firefighters and, thus, have both rescue experience and extensive experience in prehospital medical care. Most of the physicians involved in US&R are emergency medicine specialists and have also taken special courses in confined-space medicine and crush syndrome.

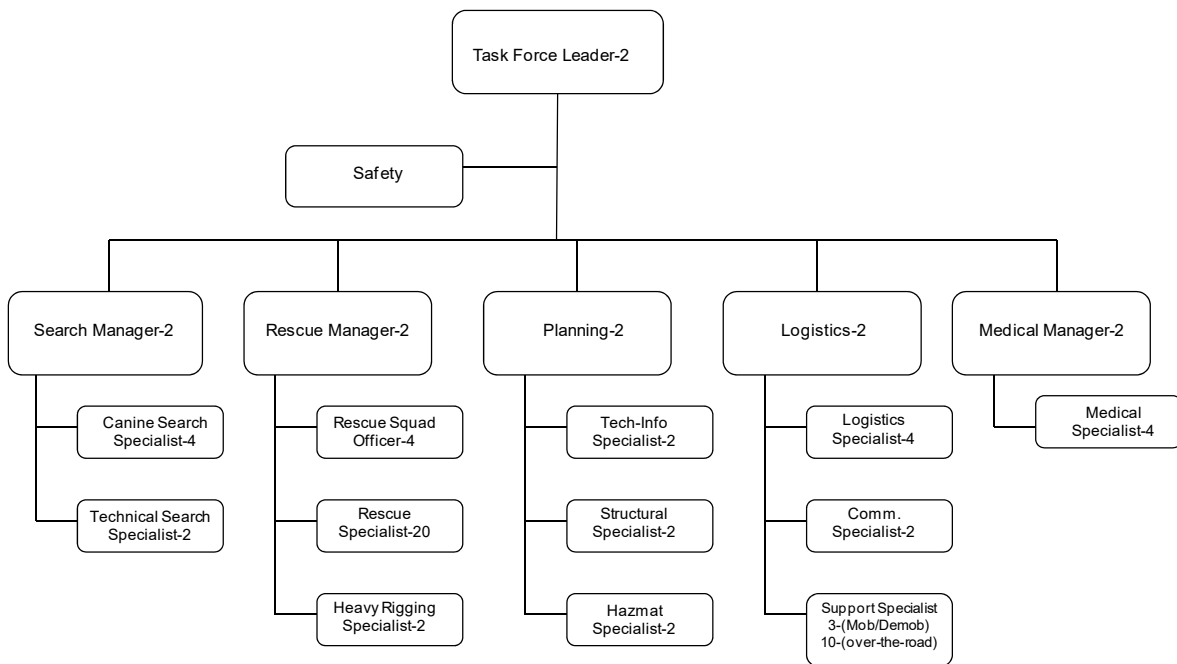
The medical team is designed to bring the emergency department out to the field. It carries all of the Advanced Life Support (ALS) equipment available in any ALS ambulance. In addition to providing advanced emergency medical care in the field, it has training in hazardous materials, public health issues relevant to disaster management, and other issues important to the function of a US&R team.

### Task Force Capabilities

Task force capabilities include the following:

- physical search-and-rescue operations in damaged or collapsed structures;
- emergency medical care for entrapped victims, task force personnel, and search canines;
- reconnaissance to assess damages and needs and to provide feedback to local, State, and Federal officials;
- assessment and shutoff of utilities to houses and other buildings;
- hazardous materials survey and evaluations;
- structural and hazard evaluations of buildings needed for immediate occupancy to support disaster relief operations; and
- stabilizing damaged structures, including shoring and cribbing operations on damaged buildings.

Figure 3-1 illustrates the organization of a typical 24-hour, State/National US&R task force.



**Figure 3-1**  
**US&R State/National Task Force**

### Private-Sector Resources

Private-sector resources can provide resources such as construction and demolition contractors (with heavy equipment and various technical specialists), search dogs and handlers, structural engineers, trained volunteer and industry teams (e.g., confined space, high-angle rope rescue, technical search), EMS providers, equipment rental and supply companies, utility companies, and trained community volunteers (CERTs).

It is important to know what resources are available from the private sector in each jurisdiction. A survey of these resources needs to be conducted as part of the response planning process in each agency with responsibility for structural collapse or technical rescue.

### Resource Typing

The State of California has developed a US&R resource typing system. Resource typing increases the effectiveness of the IC by providing specified levels of capability for a given objective and task assignment. The system has been developed using the four levels of capability (basic, light, medium, and heavy) with specified minimum levels of staffing and equipment. Resources are categorized as:

- US&R company;
- US&R crew; and
- State/National task forces.

The type of resource describes the performance capability. For example, a Type 1 US&R resource has more capability than a Type 2 (see Table 3-1). Resources are usually typed by a number, with 1 being the highest capability. The highest available capability, however, is not necessarily the right resource for the job at hand. For example, a Type 1 heavy-rescue company with the greatest capability may be available, but for a wooden structure collapse, a Type 2 medium or Type 3 light-rescue capability would be more suitable to accomplish the search-and-rescue operation.

**Table 3-1**  
**Urban Search and Rescue Resources**

Always use the prefix US&R for Urban Search and Rescue resources. Order Single Resource or Strike Team by Type (Capability--Heavy, Medium, Light, or Basic).				
Type	Type 1 (Heavy)	Type 2 (Medium)	Type 3 (Light)	Type 4 (Basic)
NFPA (Capability)	Technician*	Operations*	Operations*	Awareness*
	<ul style="list-style-type: none"> <li>Reinforced concrete</li> <li>Steel structure</li> <li>Confined-space rescue</li> </ul>	<ul style="list-style-type: none"> <li>Reinforced and URM tiltup construction</li> <li>Heavy timber</li> </ul>	<ul style="list-style-type: none"> <li>Light-frame construction</li> <li>Basic rope rescue</li> </ul>	<ul style="list-style-type: none"> <li>Surface rescue</li> <li>Nonstructural entrapment in noncollapsed structure(s)</li> </ul>

Resource	Radio	Component	Types			
			1	2	3	4
US&R company	US&R company (Phonetic)	Equipment Personal equipment	Heavy Inventory 6**	Medium Inventory 4**	Light Inventory 3**	Basic Inventory 3**
US&R crew***	US&R crew (Phonetic)	Personnel trained to appropriate level  Supervision transportation	6	6	6	6
State/National US&R task force	Preassigned two-letter State task force designator and number identifier (CA- TF5)	Equipment  Personnel transportation	US&R Task Forces are comprised of 62 people specifically trained and equipped for large or complex urban search-and-rescue operations. The multidisciplinary organization command, search, rescue, medical, and technical.			

\*Compliance with NFPA 1670.

\*\*Requests should include vehicle capabilities when necessary (e.g., four-wheel drive, off-road truck, engine, etc.).

\*\*\*The agency/department sending a US&R crew will identify the supervisor.



There are three distinct advantages to typing resources:

1. In planning.

Knowing the specific capabilities of the various kinds of resources helps planners decide the type and quantity of resources best suited to perform activities required by the Incident Action Plan (IAP).

2. In ordering.

Ordering resources by type saves time, minimizes error, gives a clear indication of exactly what is needed, and reduces nonessential communications between the incident and the offsite ordering point (dispatch center).

3. In monitoring resource use.

An awareness of the type of tactical resource assigned enables the IC or Operations Chief to monitor for under- or overcapability, and to make changes accordingly. Careful monitoring of resource performance can lead to the use of smaller or less costly resources, which can result in increased work performance and reduced cost.

Table 3-2 shows types of resources that can be combined into strike teams.

**Table 3-2**  
**Strike Team Types and Minimum Standards**

<b>Kind</b>	<b>Strike Team Types</b>	<b>Number/ Type</b>	<b>Minimum Task Capabilities</b>	<b>Strike Team Leader</b>	<b>Per Single Resource</b>	<b>Total Personnel</b>
US&R Company	AR	2-Type 1 (Heavy)	Vehicle(s) equipped for reinforced concrete, steel structures, confined-space rescue	1	6	13
	BR	2-Type 2 (Medium)	Vehicle(s) equipped for reinforced and unreinforced masonry, tilt-up construction, heavy timber	1	4	9
	CR	5-Type 3 (Light)	Vehicle(s) equipped for light-frame construction and basic rope rescue	1	3	16
	DR	5-Type 4 (Basic)	Vehicle(s) equipped for surface rescue and nonstructural entrapment in noncollapsed structures	1	3	16
US&R Crew	GR	3-Type 1 (Heavy)	Trained for reinforced concrete, steel structures, confined-space rescue	1	6	19
	HR	3-Type 2 (Medium)	Trained for reinforced and unreinforced masonry, tiltup construction, heavy timber	1	6	19
	IR	3-Type 3 (Light)	Trained for light-frame construction and basic rope rescue	1	6	19
	JR	3-Type 4 (Basic)	Trained for surface rescue and nonstructural entrapment in noncollapsed structures	1	6	19

## Tiered-Response System

A concept called "tiered response" is used by many rescue agencies across the country. The concept is to train and equip personnel or units throughout a department to different response levels, or tiers, from a basic rescue level to an advanced rescue capability.

The basic premise of a tiered-response system begins with training all personnel to a basic-rescue awareness level that familiarizes them with rescue hazards, dangers, and some basic, practical rescue skills. In the event of a complicated rescue, they will request the response of an advanced team and initiate measures within their capabilities until the advanced team arrives. This tiered-response system for technical rescue is similar to a tiered EMS response system that uses a basic emergency medical technician (EMT) to initiate care until a paramedic arrives on the scene, or the similar system used for the hazmat responses.

As an example, Los Angeles uses this approach for water rescue. All of its engine and truck companies are trained and equipped to handle a basic water rescue incident. For a more complicated situation, engine company personnel are trained and equipped to initiate basic rescue measures until the advanced water rescue team arrives.

At the top of the tier in US&R capability are the FEMA and State US&R Task Forces with mobile, multifunctional, 62-person teams equipped for the most complex and diversified rescue operations, yet reliant on support for transportation and sustained operations (beyond 72 hours) in the field. For many reasons, including cost, there are limitations on how many task forces can be fully developed. Therefore, a regional response capability is needed to provide the initial and more rapid response to various types of technical rescues, no matter how complex they may be.

The first level of response is the spontaneous "rescuer." Civilian volunteers, who are normally the first responders, can be trained to perform basic search-and-rescue operations, such as the CERTs trained in Los Angeles and many other cities and counties throughout the country. The second level, light search and rescue, and third level, medium search and rescue, are made up of trained and equipped fire and rescue agencies.

The regionalization of US&R resources usually allows the formation and response of specialized teams that can perform at the medium or heavy level of response. The FEMA and State Task Forces and properly equipped and staffed search-and-rescue companies fall into this category, using NFPA 1670 as a guide to levels of capability.

There are several advantages to a tiered-response system:

- It provides basic rescue training for all personnel.
- All potential rescuers become more aware of the dangers of different situations and recognize situations that are beyond their capabilities.
- A smaller number of personnel can develop a high level of expertise in a particular area.

- The system fits in well with a regional rescue response system where the personnel with basic training can handle a basic incident on their own and have the option of calling an advanced regional rescue team for assistance.
- It eliminates the expense and time required to equip and train all personnel to an advanced rescue level.

Table 3-3 illustrates an **example** of **possible** units and capabilities that may be associated during a tiered rescue response.

**Table 3-3**  
**Tiered Response Example**

<b>Tier Response Level</b>	<b>Units</b>	<b>Capabilities</b>
Level 4	Engine company	Light rescue (Awareness level)
Level 3	Truck company	Medium rescue (Operational level)
Level 2	Heavy-rescue company	Heavy rescue (Technician Level)
Level 1	US&R task force	Heavy rescue including search, medical, technical, and support components (Technician Level)

### **Regionalized Urban Search and Rescue Response**

Successful regionalized response systems have been developed through good planning, innovation, standardization, and the cooperation of many agencies and their chiefs. These efforts have resulted in an effective rescue response system using specialized resources through mutual-aid or cooperative agreements to provide the level of response required for the risks in each of the communities involved in the system.

Personnel from various agencies with the appropriate level of training can be brought together with the tools, equipment, supplies, and vehicles to respond as a crew, squad, team, or task force for rescue incidents within the region using standardized operational procedures under an incident command and coordination system.

#### **Developing a Regionalized Response**

Developing a regionalized response requires a systematic approach, a good plan, and initial agreements to proceed between the chiefs or administrators of the potential agencies involved.

Assuming that a risk assessment has been performed and a need requirement established, department administrators should agree to a cooperative planning effort consisting of the following:

- establishment of a planning committee;
- determination of current and required capabilities;
- preparation of an operational plan;
- determination of a program management structure;
- development of standards on personnel, staffing, training, equipment, and response;
- estimation of initial and ongoing costs and identification of funding sources; and
- development of response agreements (i.e., automatic or mutual aid, cooperative agreements, etc.).

Many fire departments across the country have established effective regional response systems. The State of California, Office of Emergency Services, coordinates the US&R statewide mutual-aid system which is based on a regional response of the nearest appropriate resource. Most of the FEMA US&R Task Forces are composed of personnel and equipment from a combination of agencies and organizations. Other examples include

- The Tidewater Regional Heavy and Tactical Rescue Team from southeast Virginia.
- The Metrocrest Specialty Response Team from the Dallas/Fort Worth Metro Region, northcentral Texas.
- The Combined Agency Response Team from Illinois.
- The Miami Valley, Ohio, US&R program.
- The St. Louis, Missouri Regional Area Technical Rescue Team.

Other systems too numerous to mention are today functioning effectively or are in the formation stages, whereas just a few years ago, this was not the case.

Effective regionalization requires people to focus on their mission and on their ability to respond to the special needs of the citizens they protect. It is time to drop the egos, look beyond your "turf," and make the commitment to work together with the best resources that each cooperating agency has to offer.

The fire service has acknowledged the need to provide a specialized rescue capability to the community it serves.

Where will we be in the next century? In some people's opinion, we will continue to improve our technical rescue capability through cooperation and support from all levels of government, the private sector, and the community, through the use of improved tools and equipment to do our job more effectively, and through increased training in the complexities of technical rescue.

Our goal is to arrive quickly with the right people and equipment to perform the rescue operation safely, effectively, and efficiently.

## **Activity 3.1**

### **Community Risk Analysis**

#### **Purpose**

To be able to identify structural collapse hazards, resource capabilities, and needs within a community.

#### **Directions**

1. Turn to the Technical Rescue Risk/Hazard and Capability Analysis Matrix.
2. Your instructor will review the form.
3. Using information from your own community, complete the columns titled "Capability" and "Requirement."
4. The "Requirement" column of the chart should reflect the resources listed in Tables 3-1 and 3-2. The "Capability" column of the chart is a list of what students have available to address these specific hazards.
5. This activity may also be completed in small groups, at the discretion of the instructor.
6. Several students will be asked to report their answers to the class.



**Activity 3.1 (cont'd)**

**Technical Rescue Risk/Hazard and Capability Analysis Matrix**

<b>Risk</b>	<b>Hazard</b>	<b>Capability</b>	<b>Requirement</b>
Earthquake, hurricane, tornado	Collapse, confined space, extrication, rope rescue		
Flood, river, lake	Water, ice rescue		
Mountains, cliffs	Rope rescue, landslide		
New construction	Collapse, confined space		
Old structures	Collapse, confined space		
Fire, explosion	Collapse extrication		
Highrise	Collapse, confined space, rope rescue		
Industrial	Confined-space extrication		
Petro/Chemical, hazmat	Confined space, hazmat		
Agricultural	Extrication		
Wells, caves, tunnels, subways	Confined space, extrication, rope rescue		
Tanks, cesspools, excavations	Confined space, rope rescue		





# NOTE-TAKING GUIDE



NOTE-TAKING GUIDE

Slide 3-1

**Unit 3:  
Response Resource  
Capabilities**

Slide 3-1

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Slide 3-2

**Terminal Objective**

The students will be able to identify various resource levels, types, and capabilities used for structural collapse incidents.

Slide 3-2

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Slide 3-3

**Enabling Objectives**

The students will:

- Define the types and levels of structural collapse risks within a jurisdiction.
- Define various levels of capability for a structural collapse incident.
- Describe resources available through local, State, and Federal agencies.

Slide 3-3

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Slide 3-4

### Introduction

The Incident Commander (IC) must be able to:

- Identify the type of collapse
- Identify rescuer and victim hazards
- Match appropriate level of rescue capability to the problem
- Determine, manage, and coordinate resources

Slide 3-4

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Slide 3-5

### Levels of Capability/Resources

- Spontaneous volunteers
- Federal Emergency Management Agency (FEMA) National Urban Search and Rescue (US&R) Task Forces
- Other agencies

Slide 3-5

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Slide 3-6

### Risk/Hazard Analysis

It is important that each department identify and understand its collapsed-structure response capabilities.

Slide 3-6

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Slide 3-7

**Risk/Hazard Analysis (cont'd)**

**Process:**

- Perform risk/hazard analysis
- Consider target hazards
- Analyze data
- Establish a risk threshold
- Determine team type and capability needed

Slide 3-7

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Slide 3-8

**Operational Capability**

This term refers to the different types of operations and resource deployment possible.

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Slide 3-9

**Operational Capability (cont'd)**

**Levels consist of:**

- Basic
- Light
- Medium
- Heavy
  - These levels correspond with National Fire Protection Association (NFPA) 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*

Slide 3-9

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Slide 3-10

### Class "Brainstorm" Session

- Government resources
- Private-sector resources

Slide 3-10

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Slide 3-11

### Qualified Operators



Slide 3-11

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Slide 3-12

### Rescue Resources

Available from:

- Local jurisdictions
- Local and State governments
- Federal government (FEMA)
- Private sector
- Trained civilian volunteers
- FEMA US&R Task Forces

Slide 3-12

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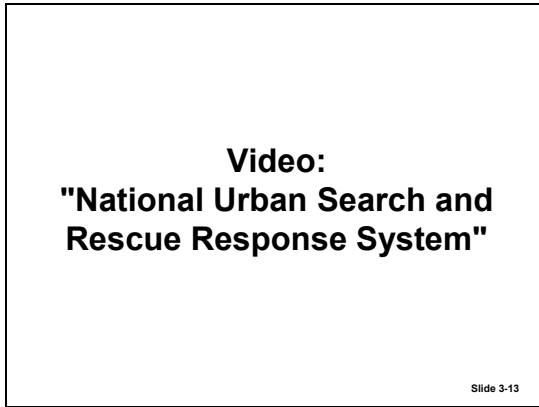
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Slide 3-15



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Slide 3-25

**Tiered Response System**

- Used by fire departments for emergency medical services (EMS) and hazmat response
- Also used effectively for structural-collapse response

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Slide 3-26



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Slide 3-30

**Other Agencies**

Coordination occurs at:

- The incident (IC and agency representative(s))
- Department dispatch center or department operating center
- Local Emergency Operations Center (EOC)
- City level (mayor)
- County EOC
- State multiagency coordination system and EOC
- Federal coordinating system

Slide 3-29

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Slide 3-31

**Activity 3.1**  
**Community Risk Analysis**

Slide 3-30

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Slide 3-32

**Summary**

- A risk/hazard analysis is needed for each community.
- Levels of operational capability and resource typing assist in developing specific response requirements.
- Structural collapse resources are available from all levels of government and from the private sector.
- Coordination of responding agencies is critical to an effective Incident Command System (ICS) for structural collapse incidents.

Slide 3-31

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## **UNIT 4: SCENE MANAGEMENT: FACTORS AND ISSUES**

### **TERMINAL OBJECTIVE**

*The students will be able to identify critical factors and issues that affect structural collapse scene management.*

### **ENABLING OBJECTIVES**

*The students will:*

- 1. Identify factors associated with rapid scene assessment.*
  - 2. Identify life safety issues.*
  - 3. Identify key elements of scene control.*
  - 4. Explain the importance of establishing appropriate incident facilities.*
  - 5. Describe the potential effects and consequences of the incident on and for the community.*
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## **INTRODUCTION**

The initial actions taken by the Incident Commander (IC) set the tone for the incident. The initial sizeup and structural triage provide information needed to do the following:

- Develop the action plan.
  - Sizeup provides the information needed to develop the Incident Action Plan (IAP).
  - Structural triage helps identify and prioritize the rescue areas with the highest probability of success.
  - Many factors regarding the collapsed structure incident must be considered to develop a rescue operational plan, objectives, priorities, Command organization, and resource requirements.
- Provide for the safety of both rescuers and victims.
  - The IC should initiate the risk management process to determine the safe commitment of resources.
  - A personnel accountability system should be used to ensure rescuer safety.
  - Hazards and dangerous working conditions may be reduced or eliminated through effective incident management.
- Increase operational effectiveness.
  - Scene control must be initiated early to establish a safe and functional worksite.

## **INITIAL SCENE ASSESSMENT**

Many factors must be dealt with when the IC arrives at an incident and attempts to size up the situation and begin operations. Incident personnel may need to perform the following activities prior to beginning structural collapse operations:

- Identify buildings individually (i.e., by address, physical location, unique design, etc.).
- Perform general area triage to identify which buildings among many in the given area offer the highest potential for viable rescue opportunities.
- Assess and mark hazards prior to search-and-rescue operations in any specific building.
- Mark particular buildings for search and rescue.

At least two possible situations exist when emergency responders arrive.

1. Civilians may have already identified viable search or rescue opportunities. This information greatly reduces the number of considerations that the IC must address. The IC must keep in mind the following factors:
  - a. The location and identification of separate buildings may be marked clearly by volunteers.
  - b. Many other general sizeup activities may have been performed by the local volunteers. The IC may base the action plan and assignment of resources on this information.
  - c. Information provided by local sources must be reviewed for validity. **The IC should not accept information as fact (when approached by local civilians reporting entrapped victims), but rather should have a complete assessment of the overall situation verified by a team manager or Company Officer (CO), or by personal observation.**
2. There may be little or no reconnaissance information available when the IC arrives.
  - a. The IC may be responsible for a geographic area (several buildings, part of a block, several-block area) with no solid information as to where to concentrate efforts. In this case, the sizeup of the situation and the decision making process become much more complex.
  - b. If no search or rescue requirements are identified immediately, search priorities should be determined based upon victim entrapment in high-probability occupancies such as schools, hospitals, multiresidence buildings, etc. (see Structural Triage).

## INCIDENT EMERGENCY MANAGEMENT PLANNING PHASES

An IC may be faced with something as simple as a single-site incident (i.e., one building or a single rescue within a building), or something as complex as multisite devastation.

Depending upon the size and extent of the devastation, the IC may be faced with situations that require immediate decisions regarding the implementation of the operational plan. This initial plan is developed from the sizeup and the assessment of the incident is continuous throughout the incident.

Once the initial assessment is underway, the IC must begin to identify the overall mission objectives, which should include

- assessing general situation at the designated rescue site(s);
- developing initial plan (objectives and strategies);
- assigning resources;

- managing ongoing operations; and
- following up on the progress and make adjustments to the plan.

IAPs follow the phases of response from small incidents through large, complex incidents to demobilization:

3. Initial response plan.
  - a. Perform sizeup.
  - b. Develop initial plan (objectives and priorities).
  - c. Request and/or assign resources.
  - d. Develop organization.
  - e. Evaluate operations.
4. Expanded response (use Incident Command System (ICS) 201 Form).
  - a. Perform sizeup.
  - b. Develop objectives and strategies.
  - c. Request and assign resources.
  - d. Provide logistical support.
  - e. Expand the organization.
  - f. Evaluate operations.
5. Extended response (use written IAP).
  - a. Perform sizeup.
  - b. Develop objectives and strategies.
  - c. Request and assign resources.
  - d. Provide logistical support.
  - e. Expand the organization.
  - f. Add to IAP as needed (safety, medical, transportation plans, etc.).
  - g. Evaluate operations.

6. Demobilization (continue IAP).
  - a. Perform sizeup.
  - b. Develop objectives and strategies.
  - c. Assign and release resources.
  - d. Provide logistical support.
  - e. Reduce the organization.
  - f. Evaluate operations.
  - g. Provide Critical Incident Stress Management (CISM).
  - h. Collect all records.
  - i. Secure site and release all resources.

## **Sizeup**

Sizeup involves obtaining information about the incident so that a plan can be developed.

The sizeup should include

- the problem's cause (how the structure collapsed);
- hazards involved (i.e., additional collapse, fire, hazmat, utilities, flooding, dust, toxic or flammable atmosphere, etc.);
- incident conditions (i.e., structural stability, time, weather, access);
- victims (how many, as well as their location, number, and degree of rescue difficulty); and
- internal or external exposures.

Appendix G contains a Structural Collapse Scene Assessment Checklist. This form is especially useful during initial sizeup and development of a response plan.

The sizeup of the collapsed structure and victim potential is much like the sizeup of a structure fire. Consideration must be given to the risk to the rescuer versus the benefit of rescuing a victim.

## **Sizeup Considerations**

The following sizeup considerations must be addressed when assessing a rescue problem.

### Time

The time of day is an important aspect when attempting to locate possible victims. In a residential structure during nighttime hours, victims may be found where bedrooms were located. At other times of the day, residential structures may have less of an occupant load. Commercial buildings may be virtually empty at night, but their occupancy grows exponentially during business hours.

The time of day may also influence the amount and type of other agency resources that may be available to assist in rescue operations.

### Occupancy

The occupancy type (residential, commercial, industrial) plays an important role in the sizeup of a collapsed building. The occupancy type, coupled with the time factor, yields valuable information about occupant load at the time of collapse.

### Age/Era of Structure Construction

The age of a building and the era in which it was constructed are important factors. The construction era of a building may reveal whether retrofit ordinances were adopted to make up for original building flaws. Understanding the age of a building and the possible retrofit programs to which it may have been subjected aids rescue workers greatly in making a safe rescue. It cannot be overstressed that unreinforced masonry (URM) buildings, having been through a retrofit program, are still **unreinforced** buildings. Particular attention must be paid to ensuring rescuer safety prior to attempting rescues in these types of buildings.

### Load Shift (Previous versus Current Load)

When a building has partially collapsed, rescuers may be lulled into a false sense of security that the building will not collapse further. The previous structural load was along an axial plane as designed and built prior to collapse, but partial collapse of the building may now have spread the load as an eccentric load. Other parts of the structure may be applying a torsional load, making further collapse of the structure likely in an aftershock, during debris removal, or possibly during normal rescue operations.

During shoring operations, care must be taken to shore the structure in the location in which it is resting. Shoring should not be used to try to push the building back to its original position. Shoring only attempts to distribute the unequal load of the building equally back to the earth.

### Construction

Different construction types have different inherent strengths and weaknesses. Ordinary construction, wood frame, and stucco offer the highest rescue potential because of the materials involved. In many cases, wood from a collapsed portion of the structure may be used for shoring

prior to attempting rescue. This type of construction is also easily penetrated using normal truck company tools. Because of its mass and strength, heavy reinforced concrete provides the biggest challenge for the rescuer attempting to cut, break, breach, and shore.

Each type of building construction and building technique produces its own characteristic collapse patterns. Knowledge of construction type, construction techniques, and collapse patterns assists responders in assessing the existence of void spaces and victim survival.

### Risk Calculations

Collapse patterns, secondary collapse potential, utilities, and potential hazardous material situations influence the risk-versus-gain calculation that must be made prior to rescue attempts. Rescuer safety is paramount and cannot be overstressed.

As with any sizeup, consider the following items when making initial risk calculations:

- placement of apparatus;
- placement of equipment;
- placement of personnel (keep only essential personnel in hazard areas); and
- placement of support functions for safety and ease of work.

Plan on secondary collapse. Have escape routes planned and make them known. Use all available safety equipment. Appoint a person to act as Safety Officer (SO) and give that person the authority to stop actions deemed unsafe. Appoint a person or persons to recon the area continually for additional signs of potential secondary collapse and additional hazards, such as utilities or hazardous materials that may not have been recognized at the start of rescue operations. Consider surface rescues of partially trapped victims before attempting more time-consuming rescue operations.

A collapsed structure with victims trapped and their location known may be an extremely emotional situation. Do not allow your emotions or the emotions of someone on your team to go unchecked. Use your head!

**Remember, for every action, there may be an equal and opposite reaction. So slow down and think things out. Rescuer safety is your number one priority.**

Each type of structure has unique characteristics that present different problems and advantages for rescuers in a collapse. In the event of failure, entire walls may fall, creating large piles of bricks or building debris, possibly trapping people on sidewalks and in automobiles. Roofs and floors may collapse completely, forming voids that may enclose trapped victims.

The problems of identifying hazards after structural collapse are extremely difficult. Buildings are often complicated and there are many different types and configurations. After the event triggering the collapse ends, the danger of further collapse is often still present. Brittle conditions pose one of the greatest threats because of the probability of sudden failure. As many hazards as possible should be identified and risk factors should be assigned to them. Measures to avoid and mitigate the danger can then be factored into the overall search-and-rescue effort.

How you proceed will depend on the amount of preplanning that has been done, how well your personnel are trained, and the resources available to effect the rescue. Search and rescue in a collapsed building is dangerous. Take your time, shore and support the structure as you proceed, and keep your wits about you; your survival depends on it and it all starts with the sizeup.

### Building Construction Type

There are four general types of building construction. It is important for responders to understand these types in order for them to make an accurate assessment of the hazards, the rescue possibilities, and the types of resources needed for the operation. The construction types and occupancy of structures determine the use of a variety of different techniques and materials. The four general construction categories that rescuers will most likely encounter in collapse situations are light frame, heavy wall, heavy floor, and precast concrete construction.

#### Light-Frame Construction

Materials are generally lightweight and provide a high degree of flexibility to applied forces such as earthquakes, hurricanes, and tornadoes. Typically, these structures are built with a skeletal structural frame system of wood or light-gauge steel components that provide support to the floor or roof assemblies. Examples of this construction type are wood-frame structures used for private residences, lowrise multiple occupancies, and light commercial occupancies up to four stories high. Light-gauge steel-frame buildings include commercial business and light manufacturing occupancies and facilities.

#### Heavy-Wall Construction

Generally, materials are heavy and are employed in an interdependent structural or monolithic system. These types of materials and their assemblies tend to make the structural system inherently rigid. This construction type does not usually use a skeletal structural frame. It uses a heavy-wall support and assembly system to provide support for the floors and roof assemblies. Occupancies using tilt-up concrete construction are typically one to three stories high and consist of multiple monolithic concrete wall-panel assemblies. They also use an interdependent girder, column, and beam system to provide lateral wall support of floor and roof assemblies. Occupancies are typically commercial, mercantile, and industrial. Other examples of this type of construction include reinforced and URM buildings that are one to six stories high for any type of occupancy.

#### Heavy-Floor Construction

Structures of this type are built using cast-in-place concrete construction consisting of flat slab panel, waffle, or two-way concrete slab assemblies. Pretensioned or posttensioned reinforcing steel rebar or cable systems are common components for structural integrity. The vertical

structural supports include integrated concrete columns, concrete enclosed, or steel frame that carry the load of all floor and roof assemblies. This type includes heavy-timber construction that may use steel rods for reinforcing. Examples of this type of construction include offices, schools, apartments, hospitals, parking structures, and multipurpose facilities. Heights vary from single story to highrise.

### **Precast Construction**

Structures of this type are built using modular precast concrete components that include floors, walls, columns, and other subcomponents that are field-connected upon placement onsite. Individual concrete components use embedded steel reinforcing rods and welded wire mesh for structural integrity. Steel beam, column, or concrete framing systems may be used for the overall structural assembly and building enclosure. These structures rely on single or multipoint connections for floor and wall enclosure assembly and are a safety and operational concern during collapse operations. Examples of this type of construction include commercial, mercantile, office, and multiuse or multifunction structures, including parking structures and large-occupancy facilities.

### **Construction Techniques**

#### **Light Frame--Wood and Stucco**

Wood is tough, lightweight, and fire-supporting. Wood performs well when nailed with many connections, as long as splitting is avoided. Connections can be bolted. Plywood sheathing of wood structures makes them very tough and resistant to earthquakes, as long as the sheathing is nailed properly. Wood-frame buildings are seen in single-family dwellings and buildings of up to four stories. They also include older balloon-frame structures and nonuniform buildings, which are corner- or odd-shaped buildings (E-, H-, L-, T-, or U-shaped).

Problems with these buildings include slipping of foundations and failure of chimneys, air conditioners, and facades. In odd-shaped buildings, cracks or separations occur at the overstressed inside corners. The more plywood shear panels used in construction, the less the damage seen.

#### **Masonry Construction**

**URM construction** exists throughout the world. Even in earthquake-prone California, there are approximately 40–50,000 URM buildings--and 7–8,000 URM buildings in Los Angeles alone. Walls are made from three or more bricks laid lengthwise, side-by-side, for four to seven courses, and then a course with bricks at 90 degrees. The 90-degree brick course is called a king's row or header row. Other recognition factors include arched windows, steel plates or concrete lintels over door and window openings, and thick walls and door openings. Lime and sand mortar is placed between the bricks. The strength and seismic resistance of unreinforced masonry is highly dependent on the mortar strength. The shear strength of mortar can vary from



15 pounds per square inch (psi) to over 150 psi; it is determined by the proportion of lime to Portland cement, as well as by the workmanship. Decorative brick veneers are a special seismic problem. A veneer was often laid up with building paper between it and the URM wall and was anchored with iron or galvanized ties. The ties normally corrode within 20 years, leaving a heavy brick face just waiting to peel off when subjected to a lateral load.

These buildings are usually one to six stories high. There is no steel reinforcement on ledges formed for the floors and roof to sit on. Even with the tie plates that anchor the joists and rafters to the exterior walls and plywood sheathing on the roof, these buildings present the greatest risk of collapse during an earthquake. The risk is greatest at the corners, which tend to blow out.

**Reinforced masonry construction** consists of cinder block or clay brick. The mortar is made of sand and cement. Grout can be used to fill vertical cavities in the block. Horizontal and vertical steel is used for additional strength. Floors and roofs are connected directly to these walls. Things to look for in this type of construction are cracks, out-of-plumb walls, and connection points pulling away from each other.

### Reinforced Concrete

**Older concrete-frame buildings** may or may not have steel reinforcement. Floors are thick and heavy and can pancake-collapse as columns punch through each floor.

**Precast concrete structures** are one to six stories high with concrete floors supported by precast columns and girders. Collapse is initiated by the failure of the joint between the slab and wall or the girder and column.

**Tensioned concrete** can have rebar for longitudinal tension stress and enclosed-type steel ties that can be tensioned as the structure is assembled. Wall-like structures of cast, precast, and tensioned concrete have out-performed frame construction in most earthquakes.

**Tilt-up concrete** wall buildings are usually one to two stories high with a lightweight roof. These buildings are made of concrete slabs that have been tilted up to form exterior walls. Prior to 1972, the walls were not placed in footings; after 1972, they **were** placed in footings. Failures occur from separation of walls and roof.

### Steel Construction

Steel construction is found in highrise buildings. Steel is tough and strong, but it needs to be fireproofed. It starts to lose strength around 700 °F (371 °C). It is ductile; that means it can be overstressed and severely bent, but it will retain enough strength to resist failure, giving ample warning of collapse. The weakest points are the connections that are welded, bolted, or riveted in older buildings. Beams must be laterally braced so as not to buckle about their weak axis from foundation shear.

## **Collapse Voids**

Void spaces are created when furniture, machinery, and other strong, bulky objects support sections of collapsed floors and walls. Larger spaces and voids are created by collapsed wooden floors, which tend to remain intact in large sections. Collapsed void spaces are divided into four major categories:

1. Lean-to collapse.
2. "V"-type collapse.
3. Cantilever collapse.
4. Pancake collapse.

All four of these collapse patterns can create void spaces in which victims may be found.

### **Lean-To Collapse**

The lean-to collapse creates the greatest chance of victim survival. This type of void space is created when a floor or roof section becomes dislodged and one end falls to rest on the floor below. The other end of the dislodged section remains attached to the wall member. Care must be taken to shore the wall properly for a torsional load.

### **"V"-Type Collapse**

This type of void space is created when a floor or roof section breaks into two pieces and collapses to the floor. It creates two void spaces, one on either side of the break. In this situation, both exterior walls are loaded with a torsional load and require shoring.

### **Cantilever Collapse**

This type of collapse is common in URM buildings where the exterior wall has been destroyed completely on one side. This may create many void spaces that have a high victim-survival rate. The actual cantilevered portion creates an extreme hazard for rescue personnel and must be shored properly to prevent additional collapse.

### **Pancake Collapse**

This type of collapse is a total collapse of many floors of a structure, creating many smaller void spaces in which victims may be located. This type of collapse requires tunneling to access the void spaces. Proper shoring techniques must be employed to allow responders to access the void spaces safely.

## Operational Considerations

The IC needs to develop an IAP that includes appropriate priorities, objectives, Command structure, and resource requirements. The development of this plan should include consideration of the following 24 rational factors:

1. Time.

The time of day provides information on the occupancy load and location of people in the structure.

2. Location.

Access is important to an effective operation.

3. Occupancy.

Knowledge of the occupancy yields information on hazards, occupant use, and the types and number of businesses.

4. Height and area.

Consider all six sides and the area involved.

5. Size of collapse area and structural hazards.

This assessment will dictate resource requirements and safe methods of rescue.

6. Fire and hazardous materials problems.

Fire or hazardous materials problems may impede a collapsed structure rescue operation.

7. Exposures.

Interior and exterior exposures should be considered to prevent additional damage or injury.

8. Utilities.

Control of gas, water, and electricity is a major safety factor for both rescuers and victims.

9. Weather.

Temperature variations affect rescuers and victims. Wind and rain certainly may create additional problems inside and outside the structure.

10. Victims.

Victim location is a priority in the initial rescue plan and may be determined by a variety of methods.

11. Traffic.

Speed of response and access to the collapse site are critical. Alternate routes and traffic control should be planned.

12. Rail.

Surface and underground rail systems may be part of the collapse problem or may affect it because of vibration.

13. Personnel accountability.

Rescue operations require a multidisciplined response from fire, emergency medical services (EMS), police, public works, building department, transportation department, volunteers, and many others.

14. Incident Command.

The complexities involved in rescue require an effective ICS to manage and coordinate operations, planning, and support.

15. Communications.

Intraagency and interagency communication capabilities are essential to effective and safe operations.

16. Medical.

Rescue medical operations need to provide for victims as well as having a component to handle the needs of responders.

17. Safety.

Safety is the top priority in rescue planning and operations and must be considered throughout the incident.

18. Special equipment.

Collapsed structure rescue operations may require the use of specialized search equipment, and portable cutting, breaking, and breaching equipment.

19. Construction equipment.

Large, mechanized construction equipment may be needed to remove debris so that rescue operations can be expedited.

20. Shoring materials.

A large amount of shoring materials may be required for safe access to victims and for structural stabilization. Preincident planning of supply sources is important.

21. Information updates.

Continuous information updates are needed during every stage of the rescue operation.

22. Staging Areas.

Staging Areas should be established for incoming resources so that the response into the rescue site can be managed effectively.

23. Responder Medical Unit, responder rehab, and relief.

Long-term rescue operations necessitate periodic rest periods for rehabilitation of rescue workers, including provisions for relief so that operations may continue without pause.

24. Secondary collapse.

The hazard of secondary collapse must be considered, whether from an earthquake aftershock or from failure of an already-weakened support structure.

## **Structural Triage**

Completing a structural triage helps to identify, select, and prioritize the structures with the highest probability of success with respect to finding and rescuing live victims. The term "triage" used in EMS is used here with the same general meaning: to sort by severity, damage, survivability, etc.

Structural triage is accomplished using the following steps:

- Obtain precollapse intelligence. This includes information from witnesses and victims, building diagrams or plans, and occupancy information.
- Deploy reconnaissance teams to evaluate structural conditions, hazards, and rescue opportunities (may use structural specialist and hazmat specialist). This information will assist in determining hazard versus risk in rescue operations.

- Analyze information and determine the best rescue risk-to-benefit ratio.
- Significant hazards such as collapse, fire, or hazmat may result in a "no go" assessment until the hazard can be mitigated.
- Prioritize rescue sites. These priorities are value judgments based on the information provided at the time. The highest priority sites are those where the most victims can be rescued safely in the shortest amount of time. The victim rescue probability assessment would involve
  - the potential number of victims trapped,
  - condition of the voids,
  - the time needed to get the victims,
  - the chance of secondary collapse, and
  - other hazards involved in the rescue.
- Continually reevaluate. Conditions change, sometimes improving and at other times becoming worse. Intelligence on the site should improve with time, thus assisting the IC in developing additional search and rescue strategies.

### Structure Triage, Assessment, and Marking System

At times, an IC may be confronted with the responsibility for a general area that encompasses multiple buildings affected by the event, with little or no search and reconnaissance information. The Structure Triage, Assessment, and Marking System is designed to help identify, select, and prioritize the buildings with the highest probability of success with respect to finding and rescuing live victims. This may not be the building with the largest number of victims or the building in the best structural condition.

It is important that information related to building identification, conditions and hazards, and victim status is posted in a standard fashion. The following procedure may be used by an IC during the first hours after arriving at an assigned location if faced with a situation of little or no information.

### Structure Triage Operations

Deploy one or two Structure Triage Teams into the area. A team should consist of:

- one Structural Specialist; and
- one Hazardous Materials Specialist.

Each team conducts a short survey of the buildings in the area. The identification of structure and location is established during the triage process. This assignment could be conducted

simultaneously at the inception of the mission while the IC deploys personnel to assess possible sites for locating the Base of Operations (BOO).

The following assumptions relate to the structure triage:

- If a large area or many buildings are involved, triage can be performed by two or more Structure Triage Teams.
- It is imperative that the teams compare assessment criteria before and after triage. This ensures that uniform evaluations are obtained.
- Some buildings may have significant hazards (e.g., structure on fire, collapse hazard, or hazmat spill) that do not allow rescue operations to proceed until the hazards are mitigated. These are given "no go" assessments. Followup marking of the structure must occur during the search and reconnaissance phase.
- Triage assessments are based upon value judgments made with rapidly obtained information. These should always be subject to a common-sense review. Adjustments may need to be made by the IC.
- Triage criteria should be reevaluated after the initial search to consider new information on live-victim locations.
- Structure marking may or may not occur during the initial structure triage phase. (A standard Structure/Hazards Marking System can be found in Appendix H.)

## **LIFE SAFETY AND PERSONNEL CONSIDERATIONS SAFETY**

Hazards at a collapse site may be numerous, involving structural failure, nonstructural damage, and environmental conditions requiring specific mitigation and protection for responders and victims. Structural collapse, which is generally classified as a low-frequency/high-risk incident, is where most of our people are killed and/or injured.

### **Collapse Hazards**

Hazards associated with secondary collapse originate in damage caused by the primary event.

**Nonstructural damage** does not carry the risk of secondary collapse. Indications may be the obvious broken window, cracks in plaster and drywall, and damage that prevents doors from opening easily.

**Structural damage** indicates that the stability of the building has been compromised. This can involve anything from doors ajar to exterior and interior walls that are racked or tilted, floors and ceilings sagging or buckled. Hazards to be aware of include the possible instability of the

building materials in the areas of the structure that are being worked in. Things to look at are the main connection points of the structure.

**Nonstructural failures such as those listed below** may result in secondary collapse.

- **Chimneys**--Failure may be indicated by cracks and partial collapse, especially in renovated structures. Chimneys may need to be taken down before any rescue work is initiated.
- **Mechanical equipment**--Air conditioners, heaters, and coolers on the roof or in the attic, or signs and billboards on the roof, pose a hazard.
- **Parapets, dormers, and facades** can be hazards, especially with newer construction. The connection points are weaker than in older buildings and facades can collapse totally without warning.
- **Glass** can always be a hazard, especially the larger and thicker pieces. If there is glass around an entry point or in a location where responders are working, break it out to eliminate any chance of it falling during aftershocks.

## **Utilities and Adjunct Hazards**

### Natural Gas or Propane

Natural gas and propane, when free in an open-air situation, are not very serious hazards. However, when either is leaking in a closed environment, it can be deadly. If you suspect a gas leak (and you should), it is important to shut off the gas at the meter. If the meter is at the location of the leak, ventilate the area before entering, if possible, and keep all civilians from entering.

When dealing with propane, remember that it is heavier than air, settles in low areas, and may not dissipate like natural gas. When it reaches a source of ignition, it can explode! Natural gas distribution lines found in the street carry from 10 to 55 psi, and the lines that feed a single-family structure are pressurized to 1/3 psi. In commercial applications, pressure can vary depending on the needs of the business; however, it will not exceed the maximum distribution pressure of 55 psi.

### Electrical Hazards

Just as in firefighting operations, it is very important to be aware of electrical hazards that could exist after a collapse. Before you enter a building, it is important that all utilities be shut off and that the area be secured with fire line tape so that no unauthorized persons can enter it.



Even when no obvious hazard exists, there can still be live wires that pose a hazard. Usually, anything over 750 volts is marked on a pole by a "high voltage" sign. Anything that is located on the pole above this sign is considered "high voltage." Transmission lines can carry up to 500,000 volts and smaller lines 34,500 volts. Transformers drop the high voltage to service currents of 240, 480, 4,800, and even 34,500 volts in some industrial and commercial applications. If these lines are down, it is very important to treat them as though they are hot.

### Hazards Associated with Water

After a collapse, it is not uncommon to find that the utility lines have been severed. Water pooling from broken pipes on upper floors may cause a secondary collapse. Water may also flow into the basement area, causing problems for victims trapped in those locations. Water also increases the possibility of electrical shock if the electricity has not been disconnected or severed.

### Hazardous Materials Situations

After any event large enough to cause a significant amount of damage, structures displaying a 704 placard should be approached with extreme caution. Chemicals in their normal state have certain properties that are predictable. When they are mixed or are involved in a fire they become totally unpredictable. Always treat any situation involving hazmat as though it were the worst-case scenario. Even buildings that do not have the 704 placard are potentially dangerous to first responders. Keep your eyes open to what is going on around you and continue to gather information pertinent to the incident.

### Fire-Related Incidents

Incidents involving fire should be handled in the same manner as a normal firefighting operation, with the following exception: an aggressive interior attack on the fire should be reconsidered. Consider what is burning, what types of life hazards exist (if any), and the condition of the structure--that is, is a secondary collapse imminent? If any of the above questions raise concerns in your mind, then discretion is the best way to approach these fires. Make sure that the exposures are covered, handle any life hazards first, and then extinguish the fire in the safest manner.

First responders can only do so much with the resources that are available at the time. It might be prudent to keep civilians away, keep responders out of these badly damaged buildings, and keep the fire from spreading to adjacent structures.

### Dust/Asbestos Atmospheres

In any collapse situation, whether from an earthquake, explosion, or collision, there will probably be a tremendous amount of airborne particulate matter. First responders need to protect themselves from whatever is in the air. There could be asbestos or other harmful things in the air which might not be immediately obvious and might not affect responders right away.

Some fire departments provide their members with dust masks. These should be worn at all times in contaminated atmospheres. If you suspect something is in the air, you should at least have a dust mask on.

### Flooding (Caused by Other Than Broken Water Pipes)

Water from something other than broken water pipes can pose a problem. A dam letting go or a swimming pool failing above a rescue site would put a crew in a dangerous position.

## **Risk Management**

Risk management is the process of evaluating and mitigating hazards in the environment. The IC must perform this activity to ensure the safety of the rescuers. Although other people within the ICS provide the IC with advice, ultimately, it is the IC who is responsible for making the "go/no go" decision.

The risk management process involves five steps.

1. **Situational awareness** involves observing and obtaining accurate information. It is the product of combining long-held attitudes and knowledge with new information as it is gathered to build a new perception. The more accurate and timely the new information, the closer one's awareness of the reality of the situation. This is the foundation on which decisions are based. Good information is the key to good decision making.
2. **Hazard assessment** consists of identifying and evaluating the hazards and their potential. Exercising judgment on the probability of a hazard and its potential severity is inherent in the hazard assessment step. Assess the potential collapse hazards, the environmental hazards, and the hazards that result from the tactics selected.
3. **Risk control** involves applying measures to reduce or eliminate the hazard. Risk controls can vary from a simple briefing that provides awareness of a hazard to shoring an unstable structure prior to entry. Providing appropriate protective gear and a communication system are also risk controls.
4. **Reaching a decision point** is accomplished by:
  - a. Evaluating hazards and risk controls.

- b. Deciding to commit (or not to commit) resources to the assignment. There are three key questions to ask before starting operations. They should all be answered **yes!**
  - Can personnel work safely in the collapse zone?
  - Does everyone understand the strategy and tactics?
  - Has a briefing been given with feedback opportunity?
- 5. **Evaluation** is accomplished by:
  - a. Ensuring that the plan is working.
  - b. Planning to evaluate continuously.

Leaders earn their pay in this step of the risk management process. You must coordinate the resources working for you so that they can accomplish the objectives of the plan. This means you should follow up during an operation to ensure that the plan is working, do continuous reevaluation of the operation to make adjustments as the situation changes, and incorporate lessons learned for future use. Whenever an adjustment is needed, it should be a cue to update the situation awareness. This puts you back at the first step of the risk management process. The structural collapse environment is dynamic and this means that you must be able to adapt to continuous change.

### **Personnel Accountability**

The IC must ensure that a personnel accountability system is established early during initial response, that the accountability level goes down through the incident organization, and that it is maintained throughout the incident. This system must include accurate information identifying company, crews, and personnel assignments and locations. Good communications and a safety plan are essential elements of this system.

Reporting procedures and signaling systems should be well understood by everyone.

Continuous documentation is important in resource tracking.

### **Incident Commander Responsibility for Scene Safety**

Hazards and dangerous working conditions may be reduced or eliminated through effective Incident Command that:

- provides leadership and organization;
- obtains accurate information and develops a plan;

- makes safety a top priority;
- assigns a SO and Rapid Intervention Crew (RIC);
- assigns an assistant SO with structural collapse training;
- provides for appropriate protective measures and safety equipment;
- rotates crews and provides Medical Unit with responder rehabilitation;
- plans for contingencies;
- monitors, isolates, confines, contains, and mitigates hazards;
- communicates and uses the Chain of Command;
- has periodic briefings; and
- plans for injuries and stress management.

## **ESTABLISHING SCENE CONTROL**

Establishing scene control should coincide with the initial sizeup and IAP.

Some of the actions the IC should take when managing the scene of a structural collapse include

- isolating the area;
- establishing zones:
  - collapse hazard zone (hot zone),
  - rescue work zone, and
  - operational work area;
- marking and identifying areas;
- evacuating bystanders and nonessential people;
- controlling perimeters is accomplished by:
  - controlling and managing spontaneous responders,
  - providing access/entry routes into worksite,
  - providing for outer perimeter access control,
  - developing a traffic plan, and
  - requesting (and using) law enforcement for this function;
- establishing site security by:
  - requiring authorization to enter site,
  - media control, and
  - use of law enforcement;
- establishing incident facilities, such as:
  - Command Post (CP),
  - Staging,
  - medical triage and treatment area,
  - base,
  - cribbing and shoring work station,
  - evacuation area, and
  - rehabilitation area;
- investigating the incident by:
  - seeking cause determination (criminal or accidental),

- preserving evidence, and
- documenting; and
- requesting assistance.

## **Rescue Site Management and Coordination**

As rescue opportunities are identified, it is important that rescue personnel adhere to a consistent, formalized site management procedure to ensure the safe, effective operation of the rescue squad(s). The following considerations should be addressed.

- Sizeup actions and site control activities should occur simultaneously. The responsible Rescue Group Supervisor should review the situation and safety issues and begin formulating a plan of action to effect the rescue. Assistance may be required from the structural and hazardous materials specialists.
- At the same time, the remaining rescue specialists should begin to take firm control of the immediate site. Their actions should include
  - assessing and mitigating hazards,
  - shutting down all utilities,
  - establishing collapse hazard zone (hot zone),
  - clearly defining the rescue work zone,
  - removing all bystanders, and
  - organizing an equipment assembly area and a cutting workstation.
- Sizeup and site control activities should be completed before rescue operations begin.
- Once the sizeup is completed and the plan of action is developed, a short team briefing should be conducted. A "thumbnail" sketch of the site features and rescue operation should be made. Team briefings improve the operation and team effectiveness, allowing all personnel to understand what is to be accomplished and to plan ahead for the required tools, materials, and tactics. In addition, safety considerations, structural concerns, hazard identification, emergency signaling, and evacuation procedures should be addressed.

## **Rescue Site Setup**

When establishing the perimeter of the operational work area, the needs of the following support activities must be provided for and properly identified.

**CP**--area used by the IC to manage and coordinate all search-and-rescue activities at the site.

**Medical Treatment Area**--location where the medical team can set up operations and provide treatment to responders and extricated victims.

**Personnel Staging Area**--place where unassigned responders are available for immediate assignment or as an RIC for immediate response in case rescue workers become trapped.

**Rescue Equipment Staging Area**--area where tools and equipment can be safely stored, maintained, and issued as needed to support the operation.

**Cribbing/Shoring Working Area**--area where building materials, lumber, and other items can be stored and processed as needed to support the onsite search-and-rescue operations.

**Access/Entry Route(s)**--A clearly defined avenue planned and identified for access to and from the rescue worksite. Personnel, tools, equipment, and other logistics needs are channeled safely through this route. In addition, controlled egress is required to evacuate a victim or injured responder quickly.

For long-term operations, consideration must be given to providing tarps or tents for the security and environmental protection of tools and equipment and for the comfort of the assigned personnel and victims.

Outside the operational work area, Staging Areas may be set up for vehicles and apparatus. An incident base also may be set up.

## **COMMUNITY CONSIDERATIONS**

A structural collapse may produce a variety of reactions and conditions in many segments of the community.

The local population is affected in various ways and to various levels. Possibilities are described below.

- Victims may need medical and emotional care, short term and long term.
- Responders may also need medical and emotional care.
- Relatives of victims may need comfort and support.

Community response may involve volunteers and donated items.

### **Volunteers**

#### **Spontaneous**

These types of people respond early to assist in the incident, during the operations, and after the response is over (during the recovery and rebuilding process). Spontaneous volunteers may or may not be trained to perform specific functions. Emergency response personnel should know how to manage these volunteers at a collapsed structure incident.

### Trained

These people may be a very useful resource if they are used safely and properly to assist the professional responders. The Red Cross and Salvation Army, for example, may be repositories of trained volunteers who may assist responders, victims, and the general population in many ways.

### **Donated Items**

The community may donate items for victims and rescuers. These may include items such as food provided during incident operations or clothing and medicine provided after the incident. Donated items require a management system so that they may be distributed where needed in a timely manner.

### **Critical Incident Stress Management**

CISM may be needed for responders, victims, and people in the community. A program should be in place to handle these kinds of situations from the agency or jurisdiction involved. Other agencies, such as the Red Cross, may be needed to assist. CISM should be

- Implemented early in the incident (CISM may include the prebriefing and defusing of responder personnel).
- Integrated into the recovery phase and into the postincident followup as necessary.

### **Community Impact**

Community impact may be significant in many areas.

### The Media

It is important to work with the media so that mutual objectives are accomplished. The media may become a positive resource in providing accurate information to the public on a timely basis. A Public Information Officer (PIO) will need to be assigned to assist with media relations and information. One of the PIO's duties will be to provide accurate and timely information to the community (through the media). Large-scale incidents in which multiple agencies are involved may require establishment of a Joint Information Center (JIC). The JIC would ensure that accurate and consistent information is disseminated throughout the incident.

### Economic Impact

A collapse involving one or many structures may have severe short-term or long-term economic effect on the community due to many factors:

- The loss of homes, causing people to move to other communities.
- The loss of jobs from the damage to the structure. In the short term, jobs such as construction may increase due to the repair and rebuilding involved.
- The loss of a special facility on which the community depends, such as a large manufacturing building. This may result in the loss of part of the community tax base and the movement of business and industry to other areas.
- The recovery phase and rebuilding may take months to years, depending on several factors, such as the community recovery plan and funding availability and quantity required for the project.



## Activity 4.1

### Scene Assessment

#### Purpose

To be able to recognize assessment factors needed to develop an IAP.

#### Directions

1. The instructor will divide the class into four teams.
2. Your team will be assigned a breakout area.
3. The instructor will present the structural collapse scenario associated with this activity. (You may wish to take notes on what you see and hear during the scenario presentation.)
4. A building floorplan (of the collapsed building) has been provided on the following page.
5. Once relocated in your breakout area, your team will do the following:
  - a. Select a team spokesperson.
  - b. Complete the Scene Assessment Worksheet.
6. The instructor will give each team one question to answer. All teams will complete Question 5.
7. At the conclusion of the allotted time, the instructor will reconvene the class.
8. Each spokesperson will have 5 minutes to report team answers to the class.
9. The instructor will assist and clarify key points.
10. Teams should keep their materials for the next exercise.

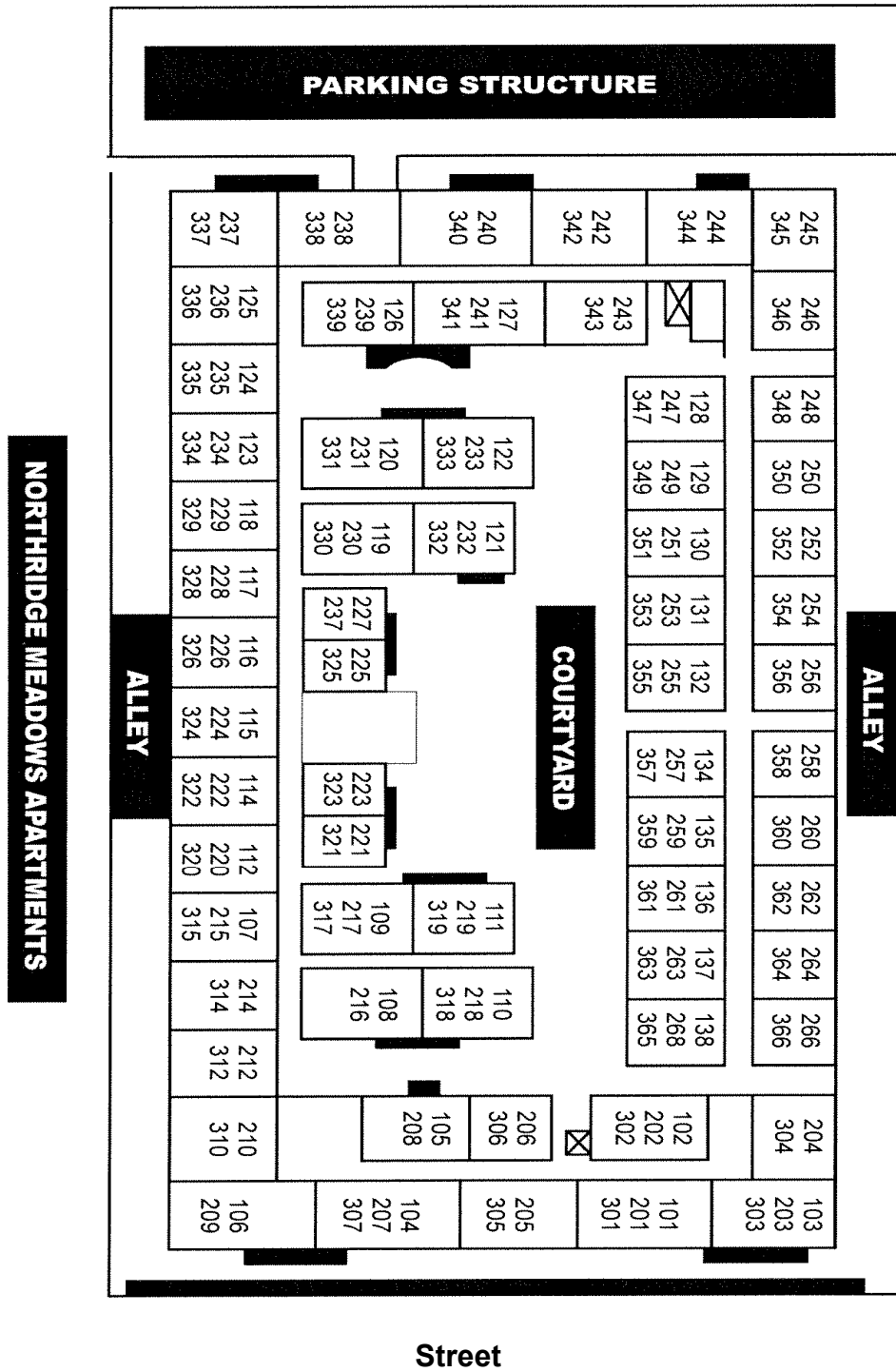
#### Scenario Information

- time of day: 0700 hours--Saturday;
- weather conditions: clear, 75 °F (24 °C), wind 10 miles per hour (mph); and
- other important considerations:
  - three-story wood-frame apartment complex,
  - dimensions: 150x325 ft,
  - number of units: 163, and
  - collapse caused by an earthquake with a magnitude of 7 on the Richter scale.



# Activity 4.1 (cont'd)

## Building Floor Plan





**Activity 4.1 (cont'd)**

**Scene Assessment Worksheet**

1. What are the incident conditions upon your arrival?

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2. What are the hazards?

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3. Where may victims be located?

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4. What factors could be used to determine victim locations?

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5. What elements should be considered in the development of the IAP?

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# NOTE-TAKING GUIDE





## NOTE-TAKING GUIDE

Slide 4-1

**Unit 4:**  
**Scene Management:**  
**Factors and Issues**

Slide 4-1

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Slide 4-2

**Terminal Objective**

The students will be able to identify critical factors and issues that affect structural collapse scene management.

Slide 4-2

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Slide 4-3

**Enabling Objectives**

The students will:

- Identify factors associated with rapid scene assessment.
- Identify life safety issues.
- Identify key elements of scene control.
- Explain the importance of establishing appropriate incident facilities.
- Describe the potential effects and consequences of the incident on and for the community.

Slide 4-3

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Slide 4-4

### Introduction

The Incident Commander's (IC's) initial actions set the tone for the incident.

- Sizeup and structural triage produce information for:
  - The action plan.
  - Rescuer and victim safety.
  - Increased operational effectiveness.

Slide 4-4

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Slide 4-5

### Incident Emergency Management Planning Phases

- Initial response plan
- Expanded response
- Extended response
- Demobilization

Slide 4-5

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Slide 4-6

### Initial Response Plan

- Perform sizeup
- Develop initial plan (objectives and strategies)
- Request and/or assign resources
- Develop organization
- Evaluate operations

Slide 4-6

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Slide 4-7

**Expanded Response  
(Use ICS Form 201:  
Incident Briefing)**

- Perform sizeup
- Develop objectives and strategies
- Request and assign resources
- Provide logistical support
- Expand the organization
- Evaluate operations

Slide 4-7

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Slide 4-8

**Extended Response  
(Use Written Incident Action  
Plan)**

- Perform sizeup
- Develop objectives and strategies
- Request and assign resources
- Provide logistical support
- Expand the organization
- Add to Incident Action Plan (IAP) as needed  
(safety, medical, transportation plans, etc.)
- Evaluate operations

Slide 4-8

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Slide 4-9

**Demobilization  
(Continue Incident Action Plan)**

- Perform sizeup
- Develop objectives and strategies
- Assign and release resources
- Provide logistical support
- Reduce the organization
- Evaluate operations
- Provide Critical Incident Stress Management  
(CISM)
- Collect all records
- Secure site and release all resources

Slide 4-9

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Slide 4-10

## Demobilization/Critical Incident Stress Management



Allow the team or groups to pay last respects or have a moment of silence before leaving site.

Slide 4-10

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Slide 4-11

## Structural Collapse Scene Checklist Sample

STRUCTURAL COLLAPSE SCENE ASSESSMENT CHECKLIST	
BUILDING NAME OR STRUCTURE TYPE	DATE
HAZARDS	
<input type="checkbox"/> STRUCTURAL INSTABILITY <input type="checkbox"/> ROOF <input type="checkbox"/> FLOOR <input type="checkbox"/> WALL <input type="checkbox"/> COLUMN/BEAM <input type="checkbox"/> OTHER	<input type="checkbox"/> CORROSION/DAMAGE <input type="checkbox"/> HANGING WALLS <input type="checkbox"/> HANGING FLOORS <input type="checkbox"/> POWER LINES <input type="checkbox"/> OTHER WIRES <input type="checkbox"/> OTHER
HAZARDS & <input type="checkbox"/> FIRE/SMOKE <input type="checkbox"/> DUST <input type="checkbox"/> BIOLOGICAL <input type="checkbox"/> OTHER	
VICTIMS	
VOID ACCESS AREAS	
SIDE A	SIDE B
SIDE C	SIDE D
ADDITIONAL	BELOW
OTHER NOTES	
(USE REVERSE SIDE OF PAGE FOR BUILDING SCENE DIAGRAM)	

See Appendix G for a more complete checklist

Slide 4-11

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Slide 4-12

## Initial Scene Assessment

Sizeup involves obtaining information about the incident so that a plan can be developed.

Slide 4-12

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Slide 4-13



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Slide 4-23



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Slide 4-24

### **Operational Considerations**

**When developing an IAP, consider:**

- Time
- Location
- Occupancy (hazards, type, multiple)
- Height and area (six sides)
- Size of collapse area and structural hazards
- Fire and hazardous materials problems

Slide 4-24

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Slide 4-25

**Operational Considerations  
(cont'd)**

- Exposures
- Utilities (gas, water, electricity)
- Weather
- Victims
- Traffic
- Rail

Slide 4-25

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Slide 4-26

**Operational Considerations  
(cont'd)**

- Personnel accountability
- Incident Command
- Communications
- Medical
- Safety
- Special equipment

Slide 4-26

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Slide 4-27

**Operational Considerations  
(cont'd)**

- Construction equipment
- Shoring materials
- Information updates
- Staging Areas
- Responder Medical Unit, rehab, and relief
- Secondary collapse

Slide 4-27

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Slide 4-28

### **Structural Triage**

Helps to identify, select, and prioritize the structures with the highest probability of success with respect to finding and rescuing live victims

Slide 4-28

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Slide 4-29

### **Structural Triage (cont'd)**

**Steps:**

- Obtain precollapse intelligence.
- Deploy reconnaissance teams.
- Analyze and determine the best risk-to-benefit ratio.
  - Significant hazards may result in a "no go" assessment.
- Prioritize rescue sites.
- Reevaluate continually.

Slide 4-29

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Slide 4-30

### **Life Safety and Personnel Considerations**

- Collapse hazards consist of:
  - Structural failure.
  - Nonstructural failure.
  - Nonstructural damage.
  - Environmental conditions.
- Low-frequency/High-risk incidents are where most of our people are killed or injured.

Slide 4-30

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Slide 4-31

### **Risk Management**

**Five-step process:**

- **Situational awareness**
- **Hazard assessment**
- **Risk control**
- **Decision point**
- **Evaluation**

Slide 4-31

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Slide 4-32

### **Risk Management (cont'd)**

**Other people in the system give the IC advice, but ultimately the "go/no go" decision is made by the IC.**

Slide 4-32

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Slide 4-33

### **Personnel Accountability**

- **The IC must ensure that a personnel accountability system is in place early during initial response.**
- **Accurate information must be provided on assignments and locations of:**
  - **Companies.**
  - **Crews.**
  - **Personnel assignments and locations.**

Slide 4-33

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Slide 4-34

### Scene Safety

Effective Incident Command will:

- Provide leadership and organization
- Obtain accurate information and develop a plan
- Make safety a top priority
- Assign a Safety Officer (SO) and an Assistant Safety Officer (ASO) with structural collapse training and Rapid Intervention Crew (RIC)
- Provide appropriate protective measures and safety equipment

Slide 4-34

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Slide 4-35

### Scene Safety (cont'd)

- Rotate crews and provide Medical Unit and rehabilitation
- Plan for contingencies
- Monitor, isolate, confine, contain, and mitigate hazards
- Communicate and use chain of command
- Have periodic briefings
- Plan for injuries and stress management

Slide 4-35

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Slide 4-36

### Establishing Scene Control



Slide 4-36

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Slide 4-37

### Media

- Structural collapse incidents are always newsworthy.
  - Assign a Public Information Officer (PIO).
  - Work with the media.
  - Provide accurate and timely information.
- Political issues may arise.



Slide 4-37

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Slide 4-38

### Economic Impact

- A collapse involving one or many structures may have severe short-term or long-term economic effects:
  - Loss of homes
  - Loss of jobs
  - Loss of a special facility on which the community depends, such as a large manufacturing building
  - Loss of community tax base
  - Movement of business and industry to other areas
  - Recovery and rebuilding may take years

Slide 4-38

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Slide 4-39

## Activity 4.1

### Scene Assessment

Slide 4-39

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Slide 4-40



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Slide 4-56

### Summary

- Sizeup provides information needed to develop the IAP.
- Structural triage helps identify and prioritize rescue areas with the highest probability of success.
- Many factors regarding the collapsed structure incident must be considered to develop a rescue operational plan, objectives, priorities, Command organization, and resource requirements.

Slide 4-56

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Slide 4-57

### Summary (cont'd)

- The IC should initiate the risk management process to determine the safe commitment of resources.
- A personnel accountability system should be used to ensure rescuer safety.
- Hazards and dangerous working conditions may be reduced or eliminated through effective incident management.
- Scene control must be initiated early to establish a safe and functional worksite.
- The effect of a structural collapse may have major implications in the community with local populations, the media, politicians, and the economy.

Slide 4-57

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## ***UNIT 5: RESPONSE FUNCTIONS***

### ***TERMINAL OBJECTIVE***

*The students will be able to describe unique operational considerations for a structural collapse incident.*

### ***ENABLING OBJECTIVE***

*The students will identify primary functions used during structural collapse operations.*

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## INTRODUCTION

The Incident Commander (IC) must be able to analyze a collapsed structure incident accurately and develop the appropriate objectives, strategies, and resource requirements to locate and rescue the injured and trapped effectively.

The following response functions may be part of a structural collapse incident:

- command and coordination;
- search;
- rescue;
- medical;
- Technical Specialists; and
- safety.

## RESPONSE FUNCTIONS

### Command and Coordination

Command provides the management function for overall incident operations. The process that Command uses consists of the following steps:

- obtain incident information;
- analyze intelligence;
- develop and select primary and alternate objectives ("what needs to be done"); and
- **prioritize** the objectives:
  - life,
  - property,
  - systems,
  - environment, and
  - situation (multiple locations).

### Developing Objectives, Strategies, and Rescue Requirements

The following is an example of developing tactics and resource requirements from initial objectives.

#### Initial Objectives

- recon site;
- identify and reduce hazards;
- establish scene control;
- search first, second, and third floors;
- rescue surface victims;

- access and explore voids and rescue victims;
- provide emergency medical services (EMS);
- support rescue operation;
- provide for crowd and perimeter control and security; and
- handle media.

### How to Implement

- deploy recon teams--recon team reports;
- control uses, stabilize, monitor, and mitigate hazmat;
- establish zones (collapse, etc.);
- organize and deploy teams;
- use search-and-rescue teams;
- rescue team opening access, shoring, and rescuing victims;
- establish Medical Group and triage, treatment area;
- establish Logistics Section;
- use police and traffic departments; and
- assign Information Officer.

The general priority to keep in mind is...

"Do the most good  
for the greatest number  
in the least amount of time."

### The Process

- Obtain incident information.
- Analyze intelligence.
- Develop and select primary and alternate objectives "**what needs to be done.**"
- Set objectives and strategies. (Strategies are "**how** it will be done"--your response options.)
- Determine resource requirements. Consider capability, availability, and tactics.
- Task resources. Tactical operation is "**who** will do it and **when** it will get done" (assign resources to response options).

- Identify logistic support requirements.
- Develop Incident Command System (ICS) organization.
- Prepare and implementing an Incident Action Plan (IAP).
- Deploy resources and order additional resources.
- Evaluate operations and progress toward objectives.
- Revise plan as needed to accomplish objectives.

## **INCIDENT MANAGEMENT**

The IC is charged with overall responsibility for the personnel, resources, equipment, and operations while on the incident scene. An important aspect of managing a structural collapse incident is the continual monitoring of the effectiveness of performance as it relates to the planned objectives.

- Are the resources committed achieving their objectives?
- If not, corrective actions and revision to the IAP are needed.

It is then the responsibility of the IC, in conjunction with the assigned tactical officers, to determine whether adjustments are required. The IC must monitor the effectiveness of the overall performance continually from a number of perspectives:

- Teams must be monitored to ensure that they function in a cohesive and effective manner.
- Monitoring must be done to ensure that individual performance is adequate.
- The proper intrateam interaction must take place. The IC must ensure that all elements are operating in concert and that there is sufficient coordination and communication.

The IC, operating at the Command Post (CP), acts as a hub for information from the members operating in the incident area.

- The IAP is based upon known or anticipated search-and-rescue requirements.
- At times during a mission operation, the IC may be presented with unexpected situations that could overwhelm their immediate resources. After a complete evaluation of the situation is made, it may be necessary to request additional resources at a rescue site location. If additional resources are not available, then a reassignment of present resources may be in order.



The assignment of incident personnel is based upon the developed operational plan and priorities for search-and-rescue tasks.

The IC must maintain close communications with their staff and subordinates. Having a communication radio channel for tactical, Command, and logistics operations is important.

A structural collapse operations report should be filled out for each worksite. Each report should include

- The personnel assigned to that location.
- Rescues made or activities undertaken.
- Potential rescue sites.
- Safety considerations.
- A drawing of the site.

These reports should be used to brief relief personnel at shift changes to ensure the continuity of the operation.

A unit log should also be maintained, listing the chronological order of events and activities during the mission.

### **Five Phases of Structural Collapse Rescue**

There are generally five phases of rescue operations at collapse incidents.

1. Phase I: Survey the area for victims and assess the collapse area.
  - Area searched for possible victims (surface/buried).
  - Evaluation of the structure's stability.
  - Utilities evaluated and shut down for safety.
2. Phase II: Remove all surface victims as quickly and safely as possible.

This may be done during the site survey.
3. Phase III: Search and explore all voids and accessible spaces for viable victims.
  - An audible callout system can be used during this phase.
  - Only trained canines or specially trained personnel should be used in voids/accessible-space searches.

4. Phase IV: Remove selected debris.

Access using special tools/techniques may be necessary after locating a victim.

5. Phase V: Remove general debris.

- This process is usually conducted after all known surviving victims have been removed.
- It is ordered when the IC determines that no other victims are alive.
- This method uses heavy equipment to demolish the building.

## **SEARCH**

The search function locates victims using various search strategies, tactics, and techniques. This function ranges from basic search operations to the use of technical search equipment and search dogs.

A systematic search enables the IC and rescue teams to increase efficiency and reduce injuries. Subdividing the collapse site into definable areas improves both effectiveness and efficiency.

The search process involves

- performing reconnaissance (identify victim locations and hazards);
- interviewing witnesses;
- locating surface victims;
- exploring places likely to contain survivors (e.g., voids);
- marking locations and documenting; and
- prioritizing search and recommending rescue operation priorities.

## **Search Strategy and Tactics**

### **Search Strategy**

The most effective search strategy should blend together all of the identified tactical capabilities into a logical plan of operation.

Following survey and reconnaissance of the area, direct efforts toward search operations in specific collapsed buildings. Small buildings do not present too great a search problem. Large or multistory buildings are complex and create difficult search situations. When concentrating efforts on a particular building, start by finding out several pieces of information:

- building's use;
- number of occupants;

- number of victims trapped and their probable location(s);
- rescue operations currently underway; and
- presence of hazards:
  - gas and utilities,
  - flammable,
  - electrical,
  - flooding from burst mains,
  - plumbing and sewer disruption,
    - secondary explosions when an explosion caused the initial incident, and
- structural stability of adjoining buildings.

**Note:** Electrical hazards present grave danger to rescuers. Utility companies will be attempting to reinstate power, thus causing possible electrocution hazards or fires.

### Victim Location

Victims found on top of the debris or lightly buried should be removed first. All rescue efforts should be directed to the victims who can be seen or heard. Rescue efforts should also be directed to those victims whose locations are known, even if you cannot see or hear them.

The initial site assessment will point toward areas of potential voids that may have given a chance to survive to a person in the area during the collapse. It is important to gather all information available from witnesses as to how many people were in the building at the time and in what locations. All the information influences the determination of the search strategy to be used.

If victim location is not known, seek out casualties by looking in places that could have afforded a reasonable chance for survival. Typical areas that should be searched are

- hallways or exit ways;
- spaces under stairways or in bathrooms;
- basement and cellar locations;
- locations near chimneys or fireplaces;
- voids under floors that are not entirely collapsed;
- intact rooms from which egress is barred; and
- voids created by furniture or heavy machinery.

### Victim Locator Unit

Normally, the Victim Locator Unit (VLU) would be activated when the location of potential victims must be identified. This would be dictated by incident needs (e.g., persons trapped and people unaccounted for). The purpose of the VLU is to locate and identify victims and witnesses involved in structural collapse incidents in order to assist in search-and-rescue operations.

The VLU is usually assigned to the Planning Section and information gained needs to be shared with the Search Group. The VLU is normally commanded by a Company Officer (CO) as the unit leader and staffed by the following personnel:

- Arson Unit investigators;
- paramedic supervisor; and
- police officers.

Unit members interview victims, witnesses, and persons with knowledge of the structure to determine the location of all occupants or other people who could be trapped or injured. Witnesses may include occupants (injured and uninjured), managers, supervisors, employees, or nearby observers. Information regarding victims should be documented with all pertinent information, including diagrams. A complete account must be made to ensure that rescue operations are timely and effective. At significant incidents, Geographical Information System (GIS) technology can be used to map the locations of potential victims.

VLU members may also assist in the cause determination investigation and in identifying potential hazards caused by the collapse. Hazard information is a high priority and should be communicated immediately to the IC.

Communications need to be addressed as part of the plan. Safety concerns make it mandatory to establish signals that will call for an immediate evacuation of a site.

### Tactical Operations

There are several tactics that can be used for locating trapped victims. No single tactic is sufficiently effective on its own to ensure that a complete search has been conducted. The selection of tactical operations is, of course, limited by the resources available.

A practical method used to determine search priorities is based on the type of occupancies affected. Those that present the highest likelihood of survivability in terms of the type of construction and occupancy of the building and the number of potential victims would receive attention first. Occupancies such as schools, hospitals, nursing homes, highrise multiresidential buildings, office buildings, etc., would be searched first. The most effective search strategy should blend together all of the identified tactical capabilities into a logical plan of operation. These strategies may include

- physical void search;
- use of electronic visual or listening devices; and
- use of search dogs.

### Large-Scale Search Priorities

One of the initial determinations that supervisory personnel may have to make at the inception of a mission is what area should be searched first. This consideration usually deals with larger geographic areas. There may be many damaged structures requiring attention.

Past experience shows that there are two general strategies to deploy search resources. The first is to divide the area geographically. Depending on the size of the damaged area and the search resources available, any area may be divided into geographic divisions by city block or other easily definable criteria.

The available search resources would then be divided and apportioned to each division for search operations. The division strategy may work well for small areas, but most likely would prove impractical for larger areas (such as an entire city or jurisdiction) in relation to the limited search resources available. The IC may consider expanding into numerically numbered branches (i.e., "Branch 1," "Branch 2") with divisions within each branch for a more effective and manageable system.

The second method is to determine the search priorities by the type of occupancies affected. Those that present the highest likelihood of survivability (in terms of type of construction) and the highest number of potential victims, based on occupancy of the building, would receive first attention.

When teams are covering large areas, they must remember that their priority is to conduct search functions to identify the location of all victims and to communicate any finds to the rescue teams while continuing the search activities. This focus on primary objectives helps to locate all victims rapidly.

### Search and Reconnaissance Team

At the conclusion of the rapid structure triage, a search and reconnaissance team should be deployed to evaluate each building deemed viable (as a result of the rapid triage) for continued search-and/or-rescue operations.

Structure and search marking should be performed during this phase and prior to the initiation of rescue operations.

In certain situations, it may be most advantageous for the IC to deploy a full search-and-reconnaissance (recon) team when initiating operations at an assigned location. At other times, it may be necessary to deploy a search-and-recon team to a remote location during the course of a mission.

A full, 10-person search-and-recon team should be staffed with the following eight positions:

1.     **Search Team Manager**--acts as team supervisor, sketches/records information, communicates details/recommendations to the IC.
2.     **Canine Search Specialists**--conduct canine search operations and redundant verifications of alerts.
3.     **Technical Search Specialist**--conducts electronic search operations.

4. **Medical Specialist**--provides treatment for located victims and/or team members.
5. **Structural Specialist**--provides analysis and advice regarding building stability, shoring, and stabilization.
6. **Hazardous Materials Specialist**--monitors atmospheres in and around voids and confined spaces; assesses, identifies, and marks hazardous-materials dangers.
7. **Rescue Specialists**--provide assistance to the search-and-recon team, including drilling/breaching for electronic viewing equipment and/or deployment of listening arrays.
8. **Safety Officer**--provides overall safety observations during the search-and-recon operations.

The search-and-recon team should conduct the following operations:

- Conduct general area and building search, reconnaissance, and evaluations.
- Perform victim location identification--this includes canine, electronic, and physical search operations. Marking the exact location with International Orange spray paint or orange surveyor's tape denotes the location of viable victims.
- Perform hazard identification and flagging--any type of personal hazard should be assessed and identified. This includes overhanging building components, structural instability or secondary collapse zones, hazardous materials, live utilities, etc. Hazard zones should be cordoned off conspicuously with surveyor's tape or fireline tape.
- Assess general atmospheric conditions in and around confined spaces or voids.
- Sketch the general search area and note all significant issues.
- Communicate findings and recommend priorities to the IC.

Specific equipment and materials are necessary for full support of a deployed search-and-recon team. This equipment should be segregated and receive priority consideration (cached and marked). This equipment should be available immediately to deploy a search-and-recon team as soon as possible.

### Search Operations

The "**Golden Day.**" This is the first 24 hours. The greatest number of living victims will be found on the first day (80 to 90 percent) and can be categorized as follows.

1. **Injured, not trapped.** These are also known as "surface victims" and usually account for about 50 percent of all victims. Injuries are usually caused by falling debris and by the victims hitting the ground. Rescues of this type are normally made by neighbors, coworkers, relatives, and civilians.

2. **Nonstructural entrapment.** These are also known as "light rescue" and usually account for about 30 percent of all victims. Rescue involves locating the victim and lifting building contents or small pieces of debris. Personnel should be able to recognize the unique hazards associated with the collapse of light-frame construction. Rescues are usually made by trained community or business Urban Search and Rescue (US&R) Teams or first emergency responders.

### Time of Day

If arriving during daylight hours, use available sunlight to prepare for the duration of the operation. Diagram the area to be searched, section-off danger areas, and pool necessary resources. Try to visualize everything necessary for a 24-hour operation. Because of reduced visibility, nighttime operations require lighting systems and the taking of added safety precautions.

### Building Use

The potential for building collapse exists in every community. Determine the search priorities in terms of the types of occupancies affected. Those that present the highest likelihood of survivability (in terms of type of construction) and the potentially highest number of victims (in terms of the type of occupancy of the building) would receive attention first--i.e., schools, hospitals, nursing homes, highrises, multiresidential buildings, etc.

### Number of Occupants

Use available information resources to arrive as closely as possible at the actual number of building occupants to determine search priorities.

### Number of Trapped Victims and Location

Victim location identification includes canine, electronic, and physical search operations. It is important to concentrate efforts where there are known victims and where possible victims are most likely to be found. Marking the exact location with International Orange spray paint or orange surveyor's tape denotes the location of viable victims.

### Rescue Operations Already Underway

It is essential that every possible search method be employed to locate viable victims before committing rescue resources to any prolonged (although well-intentioned) operation. Body recovery is not the primary mission of a search-and-rescue team. The first phase is prioritizing the locations of trapped victims by survey and reconnaissance of the entire area. Use victims' information for locating others and stay focused.

## Hazard Identification

Any type of personnel hazard should be assessed and identified. Hazardous materials, live utilities, flammables, etc., should be conspicuously cordoned off with surveyor's tape or fireline tape. Assess general atmospheric conditions in and around confined spaces or voids.

## Structural Stability

The structural specialists should provide initial assessments of relative building stability and safety in relation to the ongoing search operations. In addition, recurring assessments should be performed throughout the operations.

An important consideration in the middle to later stages of the mission is the need to reassess previously-searched structures. If the profile of a building/structure has been reduced significantly because of debris removal by heavy equipment or secondary collapse, it may become necessary to treat the structure as a new opportunity and repeat the various search procedures.

## Search Techniques

### Separate Search From Rescue

A search team member's job is to locate victims and bring the rescue team to the identified victim locations.

Search team officers must maintain control of their team and keep the team from becoming involved in a rescue effort. Other victims are depending on the search team to find them.

## Search Theory

Search activities in the urban environment most commonly involve locating or attempting to locate people who were in and around a structure at the time of collapse. A searcher conducting efforts for the victim must remember that they work **for** the victims.

Searching is hard work and demands discipline. Discipline allows the searcher to work both safely and effectively. Team members need to recognize both mental and physical fatigue. Becoming tired, bored, and indifferent are all signs of fatigue. Upon recognizing these signs, the searcher must take a break or change positions on the team. Four to six hours is the average usefulness of a searcher in a 24-hour shift.



## Search Types

There are four primary types of searches:

1. Hasty.
2. Efficient.
3. Thorough.
4. Grid.

In addition, searches may be made with specialized tools. In all instances, at the very least, a hasty search must be conducted and one type of follow-up search is required. The net result is that all survivable spaces must be searched. All teams must mark victim locations and map locations for the written record. The map is very useful in leading rescue teams to victim locations.

### Hasty Search

A hasty search is a fast, organized response to check areas most likely to produce surviving victims. This method must be employed on arrival to find the most obvious victim locations, indicated by calls for help, moans, or exposed body parts.

During the hasty search, keep moving. Stop only to call out to victims and listen for a response. You may also stop to mark hazards and to attempt surface rescues. **Note:** This is the only time the search team may perform rescues. If the number of surface victims is large, let the rescue team assist them. The main criterion for a hasty search is speed, not thoroughness or efficiency.

There are two objectives of the hasty search:

1. Quickly check high-probability areas.
2. Obtain information about search area.

### Efficient Search

The efficient search is a relatively rapid systematic search of segments of the area that produce high probabilities of detection.

The main criterion for this search is efficiency, not speed or thoroughness. This method involves moving debris, taking more time while sounding and searching the most survivable areas. Again, rescue teams must be brought in as victims are located.

## Thorough Search

This search is a slow, highly systematic search using the most thorough methods to provide the highest probability of detection. The main criterion for this search is thoroughness rather than speed or efficiency.

## Grid Search

A grid or line search involves a slow, methodical search of an area and is usually employed to produce clues, not victims. Searchers walk in the same direction at the same pace. They are spaced according to the number of searchers and the amount of area to be covered.

## Victim Location

### Surface/Lightly Buried

Surface victims are the most easily located. Many of them will have effected self-rescue prior to the arrival of emergency personnel.

### Known Locations

Known victim locations are determined through witnesses's statements and by listening for the victims calling for help or signaling from inside the structure and under the rubble.

### Potential Voids

Noting the type of collapse, the direction in which the building has moved, and the distance the building has moved, helps to identify possible voids. Searching these voids increases the probability of detection.

### Possible Safe Areas

Taking into account the time of day and building use, consider the following places as possible areas of relative safety for victims:

- hallways/exits;
- basements/cellars;
- voids from beds and furniture;
- voids from machinery; and
- voids from vehicles.

## Physical Void Search

**Formation of voids.** After a collapse, sections of the floors, walls, and roof may fall in large pieces. These pieces may become wedged or positioned so that spaces of different sizes and shapes are formed beneath them. These are called voids. Victims may be located in these voids--alive. The more common types of voids are referred to as the lean-to floor, lean-to cantilever, the V-shape, the pancake, the overturn collapse, the combination, and the individual void.

### Lean-to Floor Collapse

The lean-to floor collapse occurs when one of the supporting walls fails or when floor joists break at one end. With this type of collapse, the collapsed section is usually supported at both ends. That is, the uppermost edge is supported by the wall and the lower portion is resting on the floor or debris. This type of collapse usually creates a good-sized void.

### Lean-to Cantilever Collapse

The lean-to cantilever collapse, or hanging type, occurs when one end of the floor or roof section is still attached to portions of the wall. The other end (or ends) is not supported at all and is hanging free. Without a doubt, this type of collapse is the most dangerous.

### V-shaped Collapse

The V-shaped void results when heavy loads cause the floors to collapse near the center. This type of collapse creates voids at each end below the floors.

Common to all three types of collapses listed above is the location of the potential victims. Occupants above the collapsed floor will likely be found in or under the debris at the bottom end of the collapse. This is usually because the contents of the floor slide toward the collapsed area and take the occupants with them. The occupants below the collapse may be found in the supported void areas underneath the floor.

### Pancake Collapse

The pancake collapse is the result of total bearing wall or column failure of an upper floor, causing excessive weight on the next and lower floors, thereby dropping all floors to a lower level. Victims may be found between layers of flooring. The more fortunate may be protected by a strong supporting object.

### **A-frame Collapse**

An A-frame collapse occurs when flooring separates from the exterior bearing walls but is still supported by one or more interior bearing walls or nonbearing partitions. The highest survival rate for trapped victims will be for those near interior partitions. Other victims may be located in the debris near exterior walls.

### **Overturn Collapse**

The overturn collapse is a condition that occurs when a building is literally laid over on its side. This can be caused by a column tension failure or a shear wall overturning inadequacy. Spaces that were vertical become horizontal and vice versa. Elevator shafts become access hallways. The overturn collapse can be prevalent in liquefaction areas of an earthquake.

### **Combination Collapse**

The combination collapse can be a combination of the types already listed in one structure. This type of collapse can produce many void areas and is very hazardous.

### **Individual Collapse**

Individual voids are created when furniture, machinery, and other strong, bulky objects support sections of floors and walls. It is worthy of note that the larger spaces and voids are created by wooden floors that tend to remain intact and in large sections, and by cellar or basement walls, where the thickness and absence of stresses resist tendencies to collapse.

## **STAGES OF SEARCH AND RESCUE**

Immediately after a disaster that may cause structural collapse, the rescue services must function with speed and precision to free trapped victims. Every rescue operation, therefore, should proceed in stages and according to a regular plan.

While hard-and-fast rules cannot be applied to every situation, a systematic approach to the problem ensures a higher degree of efficiency, resulting in saving more lives and minimizing the danger to rescuers.

Locating and extricating the trapped persons presents the rescuer with a most challenging problem. The speed with which the casualty is removed and the degree of danger to both the rescuer and the rescued depend, to a large extent, on the methods and techniques employed.

The search stages are as follows:

## **Stage I**

**Reconnaissance**--The general survey and sizeup of the damage area, gathering of facts, and abating of hazards. Find out the building's purpose and use; the number of occupants; the number of victims trapped and their probable location within the building; whether there are rescue operations currently underway by others; the nature and extent of damage; the danger of fire traveling in confined spaces; the presence of flammable liquids, poisonous gases, and chemicals; the location of live electrical wires and main electrical panels; the possibility of flooding from burst mains, plumbing, and sewers; and the possibility of additional collapse of the building or adjoining structures.

**Immediate rescue of surface casualties**--The rescue of victims found on top of the debris and of those partly or lightly buried. Simultaneous with or immediately after the initial survey, all efforts should extend toward rescuing survivors who can be heard or seen, or whose exact location is known, even if they cannot be heard or seen. As victims are removed from the debris, a triage and treatment site must be established. This site should be away from the immediate rescue area so that medical treatment and rescue efforts do not conflict. The establishment of Casualty Collection Points (CCPs) should be started as soon as possible in a location away from the collapse site.

**Scene organization and management**--This is probably the most difficult to establish at the beginning of a large-collapse event. The IC must try to manage the chaos, and at the same time, institute a Command system. They must determine resource needs; organize the rescue effort; organize the triage treatment and CCPs; assign resources as they arrive; and direct those civilians currently effecting rescue.

## **Stage II**

**Exploration and rescue from likely survival places**--Likely survival places may be identified by victims, rescuers, and victim locator devices--such as rescue dogs, listening devices, fiber-optic video cameras, infrared video cameras, and sonic- and heat-sensing devices.

Rescuers need to search strong or sheltered parts of a structure, even though no definite information is available that victims may be trapped in such places. This does not mean that every possible hole and corner of a building needs to be searched, but rather that likely areas of shelter should be looked for and fully explored. The essential purpose is to recover living casualties by seeking out places that would have afforded a reasonable chance of survival. The exact places thus explored depend, to a large extent, on the type of collapse, the extent of damage, and whether or not there was any warning of collapse. The possibility of a warning may help pinpoint the location of persons immediately prior to collapse.

Typical areas that should be searched are spaces under stairways, basement and cellar areas (foundation walls may remain intact and form part of a void), locations near chimneys or fireplaces, voids under floors which have not entirely collapsed, intact rooms having exits barred by debris, and voids created by heavy furniture or machinery.

It is impossible to put too much emphasis on the importance of searching areas for victims who may still be alive, and the importance of effecting their speedy release before making any attempt to rescue victims with much less chance of survival. Before deciding which of the several victims should be rescued first, the position of each victim and the work involved in the rescue should be considered in relation to the position of the others and the difficulty of extricating them. The ideal procedure is, of course, to carry out both tasks simultaneously, if possible.

### **Stage III**

**Locating casualties using the hailing system**--Place rescuers in calling and listening positions. The rescue officer in charge of the operation calls for complete silence. Silence is very important so the rescuers can concentrate on listening for the faintest sound from victims buried in the rubble.

Going "round-the-clock," each rescue member calls out or taps some object. All others listen to determine a "fix" on any sound they may hear. There should be a short period of time for listening between instances of calling or tapping. After any sound has been picked up, at least one additional "fix" should be attempted from another angle. This should minimize the possibility of making a mistake in locating a casualty, as the source of the sound coming from beneath the rubble may be deceptive.

Once communication has been established with a victim, it should be maintained continually. This keeps the victim's morale up, helping him/her withstand pain and discomfort. It also helps rescuers work in the right direction. The victim may be able to give warning of any movement of debris likely to cause further injury and to give direction and advice, helping to preclude any indiscriminate movement by rescuers.

## **RESCUE**

The rescue function begins with an evaluation of compromised areas, structural stabilization, and access. The rescue process then involves the extrication of victims using a variety of tools appropriate for the task.

The term "Golden Day" describes an 80-percent survival rate for victims extricated within 24 hours. A well-organized and rapid response is critical to the success of the rescue operation.

The factors involved in prioritizing rescue opportunities include

- victim viability and longevity;
- degree of difficulty and duration;
- rescue outcome potential (multiple victims versus single); and
- safety considerations (rescuers and victims).

## **Tactical Considerations**

### **Evaluating Rescue Opportunities**

The critical responsibilities of the rescue team managers and squad officers are to determine, evaluate, and prioritize rescue extrication operations involving live, trapped victims. There are generally five phases of rescue operations at collapse incidents.

1. Phase I: Assessment of the collapse area. The area is searched for possible victims (surface and/or buried) and the structure's stability and potential danger to rescue personnel is evaluated. All utilities must be evaluated and shut down for safety.
2. Phase II: Removal of all surface victims as quickly and safely as possible. Extreme care must be used during this phase to ensure that rescue personnel do not become victims. Personnel should not be misled by the outward appearance of the structure. What appears to be a settled pile of debris could, in reality, lack any genuine support and a secondary collapse could occur.
3. Phase III: Search/exploration of all voids and accessible spaces (created as a result of the collapse) for viable victims. An audible callout system can be used during this phase. Only trained dogs or specially trained personnel should be used in voids and accessible-space searches.
4. Phase IV: Removal of selected debris using special tools and techniques (necessary after locating a victim). It may be necessary to remove only certain obstructions that are impeding access to the victim. Information concerning a victim's location prior to the collapse can be helpful during the selected-debris-removal phase. Information-gathering on other possible victim locations can greatly enhance the operation.
5. Phase V: Removal of general debris (usually conducted after all known victims have been removed). Exceptions would be: 1) when information is obtained that indicates the possible presence of other victims not originally accounted for, and 2) when large amounts of debris are impeding or obstructing operations. The decision to use heavy equipment during this phase must be weighed carefully and seriously, especially when the possibility exists that there are still live victims in the debris.

### Rescue Versus Body Recovery

Rescue operations follow a logical sequence of emergency actions. As rescuers take the time to progress through these phases, experience demonstrates that the survival of trapped victims is greatly reduced.

Rescue operations in collapsed buildings are usually difficult, lengthy, and dangerous. Rescuers must weigh the time value scale of their operations. Every possible search method must be employed to locate viable victims before committing to any prolonged rescue operation. Body recovery is not the primary mission.

### Degree of Collapse

Degree of collapse can be classified as light, medium, and heavy.

#### Light

Superficial damage has occurred to the building or structure (broken windows, plaster, etc.). With this type of collapse, victims will most likely self-rescue. Rescue operations are limited, as are the tools required.

#### Medium

Structural stability for this type of collapse is questionable. Walls may be tilted or fractured and walls or foundations may be displaced. For a medium collapse, victims will need to be located; evacuation and extrication prioritized; and rescue operations implemented. Shoring and cribbing must take place as required.

For a medium collapse, a minimum number of rescuers should be within the building. Standard truck company tools can be used (jaws, rotary-chainsaws, pry bars, airbags, hydraulic jacks, etc.).

#### Heavy

This is characterized by partial or total collapse of floors, walls, ceiling, or roof. Obvious structural instability exists. Locating victims may require specialized tools or devices. Extrications must be well thought-out and must consider hazards, equipment, time, etc.

Truck company tools, Federal Emergency Management Agency (FEMA) US&R equipment, and available heavy equipment can be used.

Coordination and safety must be emphasized.



### Potential for Further Collapse

When an earthquake or other natural disaster collapses a building, a driving force has overcome the strength of the building materials and its connecting points. Normally, walls support the weight of floors and roofs. As shifting occurs, weakening or complete collapse of floors, walls, roofs, and ceilings may occur. Further collapse may occur with normal settling, aftershocks, or rescue operations involving lifting, cutting, and prying. Rescuers must be aware of their surroundings:

- the age and condition of the structure;
- walls out of plumb;
- beams separated from walls;
- large cracks or openings;
- overloading of specific areas; and
- noises and vibrations.

Shore and crib or take other appropriate actions to mitigate the potential for further collapse.

### Building Type/Construction

Identifying hazards after a structural collapse is difficult. Varying types, styles, and configurations, ages, and uses of buildings only complicate rescue considerations. Rescuers must identify all possible hazards and options.

- six-sided assessment of the hazards involved;
- basic knowledge of the building's construction, characteristics, weaknesses, and strengths;
- awareness of materials used within the construction; and
- collapse patterns and creation of voids within different types and styles of construction.

In general, be aware of three types of hazards within any type of construction:

1. Falling.
2. Collapse.
3. Hazardous materials, natural gas, etc.

### **Rescue Techniques**

One or any combination of rescue techniques may be used for a rescue operation:

- shafting/tunneling;
- trenching;

- breaching walls/floors; and
- support of structure/shoring.

Selection of technique varies with the structural conditions and problems, hazards, equipment manpower availability, and the overall safety of rescuers.

With all of the above techniques, follow some general rules:

- be aware of surroundings;
- shore often and properly (lives may depend upon it);
- attempt to leave open a quick means of egress or safety;
- back rescuers up for safety and relieve often;
- plan, coordinate, and communicate; and
- make safety the watchword.

### Shafting/Tunneling

- Ensure adequate amounts of available cribbing and shoring materials.
- Ventilate if within a confined space or if the space is oxygen-deficient.
- Evaluate soil or debris stability and conditions.

### Trenching

- Use the same precautions as above.
- With use of heavy equipment or tools, consider vibration and exhaust.
- Wear lip protection.
- Use tag lines and limit personnel to qualified and trained rescuers within the trench.

### Breaching Walls and Floors

- Consider the consequences of debris falling upon victims and the reduced integrity of walls and floors.
- Use the proper tools for the job.
- Consider possible electrical and/or hazardous atmospheres.

- Remove debris to create a safe working environment.

### Support of Structure (Shoring)

Sufficient shoring and cribbing materials must be available. Use the site as a resource and acquire materials that are flat and can support the weight. Form an equipment and resource pool along with a nearby cutting station.

Shore often, properly, and with solid materials from a surface that can withstand the pressure and weight of the supported area.

## **RESCUE OPERATIONS**

The operational plans for a FEMA US&R Task Force upon arrival at an incident are explained below. The functions that take place are useful for any structural collapse operation.

When a task force arrives at an assigned site location, it may find a variety of complex situations that could range from a single-site disaster (i.e., collapse of one major structure or a disaster area small in size) to a large multisite emergency. The management and coordination of the task force will depend upon the situation(s) and needs at the location, coupled with the available local resources and the progress that has been made (if any) to that point. The source of information should be the IC of the local jurisdiction.

At times, it may be necessary for the task force to begin rescue operations in one of the middle phases. In all likelihood, local emergency response personnel will probably have completed at least the first two phases prior to the arrival of a task force. Thus, in the event that a trapped victim has been located in a void, rescue operations may begin during Phase III or IV, depending upon the conditions at the site. When this occurs, the Rescue Officer in Charge (OIC) must ensure that all personnel involved in the operation are aware of all actions taking place. Any time rescuers are working in voids or accessible openings, all work in progress above, below, or around the site should cease until rescuers and victims exit the void or opening. Proper communications must be maintained, both horizontally and vertically, in the task force organization, during these operations.

The most perplexing strategic decisions will probably involve choices among multiple rescue opportunities, with the number of opportunities surpassing the rescue resources of a task force. In this situation, task force management personnel should prioritize rescue opportunities. Personnel safety and the benefit of the greatest number of people should be the guiding principles. This would involve factoring in victim viability and longevity, degree of difficulty and duration of each rescue opportunity, possible end results of rescue efforts (e.g., a single-rescue operation yielding the extrication of two or more victims, etc.), and safety considerations for rescue personnel (e.g., some sites may prove too dangerous to conduct rescue operations). These factors must be evaluated all together to arrive at the best possible rescue prioritization.

Decisions regarding personnel deployment and commitment (e.g., shift rotations or full-scale "blitz") must be considered, as must the integration of local and military personnel and/or convergent volunteers into the multiple-rescue operations.

### **Rescue Integration in Search Activities**

Task force rescue personnel may be required to assist the canine and technical search personnel with search-and-recon activities. This may include safety assessments at collapse sites, gaining access to voids and other difficult areas, deploying equipment, conducting physical search operations (either separately or in conjunction with the canine/technical search operations), etc. Certain search operations may require shoring/stabilization operations prior to entry. In addition, either individual void inspections or combined listening operations can be conducted, as necessary. These combined operations would be coordinated between the search team and rescue team managers in conjunction with the rescue squad officers or other appropriate task force personnel.

Rescue personnel may be most effective using electronic viewing equipment (fiber optics, search camera, etc.), in conjunction with concrete hammer/drills, for pinpointing the exact location of victims. This combination may also be used for general void searches within collapsed buildings. Past experience has shown success with rescue personnel drilling an array or series of holes (in a floor or wall, for example) and one or more operators following along with the electronic device(s) making quick assessments through the drilled holes.

The task force staffing within the search element provides two technical search specialists. These personnel will usually use the electronic acoustic/seismic listening devices as their primary tool. Other task force personnel (preferably rescue personnel) may be required to assist the technical search specialists and also act in the overhead function to ensure overall safety.

Another general classification is physical search operations. This includes deploying personnel over and around a collapse site. Rescue personnel may be deployed to make separate visual assessments in voids and confined space areas for any indication of victims. They may also be used in a coordinated fashion as an array of listeners. A bullhorn or hailing device is used to provide direction to trapped victims. The area is then silenced, and personnel listen and attempt to pinpoint the location of the noise. This operation is less exacting than the others and poses a significant risk to the personnel involved in the operation.

In all cases, personnel conducting search operations should sketch the general features of the structure/area being searched, noting any significant information on the sketch for future reference. This information should be forwarded to the task force managers. Rescue personnel may be used to staff one or two search-and-reconnaissance teams.

## **Rescue Site Management and Coordination**

As rescue opportunities are identified, it is important that rescue personnel adhere to a consistent, formalized site management procedure to ensure the safe, effective operation of the rescue squad(s). The following considerations should be addressed.

Size-up actions and site control activities should occur simultaneously. The Rescue OIC should review the situation and safety issues and begin formulating a plan of action to effect the rescue. Assistance may be required from the structures and hazardous materials specialists. At the same time, the remaining rescue specialists should begin to take firm control of the immediate site. This should include

- **Hazard assessment and mitigation.** This could be as simple as removing tripping hazards, boards with exposed nails, etc., as well as evaluation and shutoff of utilities, or other necessary actions. The shutdown of all utilities is mandatory, especially when personnel are operating on or in the collapse hazard zone. This important aspect of rescue operations must always be emphasized.
- **A collapse hazard zone (hot zone)** should be established around the compromised structure.
- **The rescue work zone should be clearly defined.**
- **All bystanders should be removed** from inside the cordoned-off work zone.
- **An equipment assembly area and cutting workstation should be organized** at an advantageous location inside or adjacent to the cordoned-off work zone.
- **Sizeup and site control activities** should be completed before rescue operations begin.

Once the sizeup is completed and the plan of action is developed, conduct a short team briefing. Make a "thumbnail" sketch of the site features and rescue operation. This can be drawn quickly on a legal pad or reusable marker board, and can be used to apprise all personnel involved in the operation of the plan of action. In this case, a picture is certainly worth a thousand words. The team briefing will improve the operation and team effectiveness, allowing all personnel to understand what is to be accomplished and to plan ahead for the required tools, materials, and tactics. In addition, safety considerations, structural concerns, hazard identification, emergency signaling, and evacuation procedures should be addressed at this time. The Task Force Operations Report may be used for this purpose.

As stated, each functioning rescue site must have a clearly designated Rescue OIC (and Rescue Safety Officer if required) for effective site management and coordination.

## **Rescue Worksite Setup**

In order to ensure safe and effective rescue operations, the responsible Rescue OIC must establish control of the area immediately surrounding the selected worksite. This is done for two primary purposes:

1. To provide a collapse/hazard safety zone (hot zone).
2. To provide an operational work zone for the task force personnel assigned to the site.

A **collapse/hazard safety zone** (hot zone) is established to control all access to the immediate area of the collapse--the area that could be affected by further building collapse, falling debris, or other situations (e.g., aftershocks) hazardous to personnel. The only individuals allowed within this area are the primary task force personnel directly involved in search for or extrication of victims. All other task force personnel must be located outside the hot zone until assigned or rotated. The collapse/hazard zone will be identified by an X-type cordon of flagging or rope (crisscrossed).

An **operational work area** is established to control access to the rescue worksite--except for assigned task force members, military personnel, volunteers, and other local rescue personnel involved in an operation--and to provide safe and secure work areas for the personnel supporting the rescue operations. The operational work area will be identified by a single horizontal cordon of flagging or rope.

## **Rescue Site Setup**

When establishing the perimeter of the operational work area, the needs of the following support activities must be provided for and properly identified.

- Operational post--Area used by the Rescue OIC assigned to manage and coordinate all US&R activities at the identified rescue site.
- Medical treatment area--Location where the task force medical team can set up operations and provide treatment to task force members and extricated victims. Medical team personnel must identify their space requirements to rescue personnel when this area is being established.
- Personnel Staging Area--Where unassigned task force members can rest, eat, and be immediately available in case the assigned rescue workers become trapped or when needed in the rotation.
- Rescue equipment Staging Area--Where assigned tools and equipment can be safely stored, maintained, and issued as needed to support the operation. An appropriate area should be identified where generators and other gasoline-powered equipment can be set up and operated without exhaust gases and excessive noise hindering the operation.

- Cribbing/shoring working area--Where building materials/lumber can be stored and processed as needed to support the onsite search-and-rescue operations.
- Access/Entry route(s)--One or more clearly defined avenue should be planned and identified for access to and from the rescue worksite. Personnel, tools, equipment, and other logistics needs are safely channeled through this route (in addition, controlled egress is available when required to evacuate a victim or injured task force member quickly).

Give consideration to the security needs and environmental protection (tents/tarps) for the tools, equipment, and comfort of the assigned personnel and victims.

### **Rescue Site Personnel Use**

Effective use of task force personnel is a major element of the tactics necessary for productive rescue operations. It is imperative that all personnel clearly understand the Command structure (those designated as Rescue OIC or other management positions on the rescue site) and their duties and responsibilities.

Rescue assignments for task force personnel generally flow down through the Chain of Command (e.g., 1) the task force leader assigning worksites to the team manager, 2) the team manager specifying areas of responsibility for subordinate task force personnel). Assignments may vary from single-site operations to multisite operations. The rescue team manager should designate one of the rescue squad officers as the Rescue OIC of any operation requiring the assignment of two (or more) rescue squads to a single, complex operation. The alternate rescue squad officer should assume the position of rescue safety officer.

The assignment of rescue personnel is the responsibility of the Rescue OIC and must be understood clearly by all team members. At times, considerations requiring rescue team responsibilities and assignments must be based upon the challenges being faced and the qualifications and expertise of the team members. Effective use of team personnel must be the prime consideration of the officer making assignments.

Some operations in which rescue personnel are involved in victim search or extrication may pose the threat of secondary collapse on the rescue personnel (e.g., working in the collapse "hot zone," below-grade operations, operating in voids or accessible openings, etc.). In these situations, a standby rescue team must be stationed at the designated Personnel Staging Area in a full state of readiness, in the event that rescue personnel become trapped or require other assistance.

At least one rescue specialist should be assigned to the Rescue Equipment Staging Area at the rescue site. The rescue squad officer should appoint this position at the time of the initial squad briefing, prior to beginning rescue operations. Procedures for accountability of equipment are conducted in accordance with the Property Accountability and Resource Tracking System. In the event that a request is made for the loan of tools or equipment to other than task force

members, the designated Equipment Staging Area manager will make proper notifications and documentation, and ensure followup for the return of the items.

## **INTERDISCIPLINE COORDINATION**

As the rescue team managers and squad officers focus on the appropriate tactics and procedure related to victim extrication, they must also address the interrelationship of other task force disciplines in the ongoing operations. These would include the following:

### **Structure Specialists**

These people must be involved in ongoing rescue extrication operations, especially those involving significant cutting, breaching, moving, and lifting operations. The Rescue OIC should request structural assessment assistance in the development of the rescue plan of action initially, and receive periodic review during the course of the operation.

### **Hazardous Materials Specialists**

They should assist search-and-rescue personnel with initial site analysis prior to search or rescue operations. This would include identification of any hazardous products, as well as evaluation of the general atmosphere around and within the involved structure. Periodic review may be necessary during extended operations.

### **Medical Specialists**

These individuals provide medical assessment, intervention, and stabilization which are essential to the survival of the trapped victims both during and after extrication. Rescue personnel should ensure that Medical Team personnel have access to the victim as soon as possible. This may require temporary cessation of rescue operations. The benefits of immediate medical intervention and stabilization of the victim greatly offset the disadvantages of any time lost.

Of significant importance is the coordination of any actual weight removal from live, trapped victims. This must be closely coordinated with the medical personnel. The effects of crush syndrome, whereby toxins and other byproducts of restriction of blood flow are suddenly released into the victim's system, can quickly lead to death. Medical intervention and appropriate IV therapy can offset this condition.

Medical personnel are also responsible for monitoring all personnel involved in the operations for excessive critical incident stress, exhaustion, water intake and hydration, injuries, and any other conditions that may require intervention.



## **Heavy Equipment and Rigging Specialists**

These people may provide recommendations that should be considered during rescue operations requiring the integration of cranes, large-scale lifting operations, heavy equipment movement, etc. In addition, the heavy equipment and rigging specialists must act as liaisons between the rescue squads conducting the rescue and the non-task force equipment operators, who may not fully understand the subtleties involved.

## **Technical Information Specialists**

Services provided by these people should, in certain situations, be requested by rescue team officers to document significant aspects of a rescue. This process may include both still and video photography of operations, as well as collection of information (e.g., building plans, capturing timeframes of the duration of operations, exposure records for rescue personnel, etc.).

Rescue team officers may have to integrate the services of other non-task force personnel into ongoing operations. This may include local utilities personnel (gas, electric, water), law enforcement, military, and convergent volunteers. The assistance of these entities should not be overlooked when needed.

## **SITE/PERSONNEL SAFETY**

Safety of the task force personnel is the single most important consideration during mission operation. Rescue team officers must ensure that this remains so throughout rescue operations and the mission in general. This prioritization covers not only the input and advice of the technical team specialists as outlined, but the development of rescue action plans, choice of tactics, and management and coordination of operations. At a minimum, the following considerations should be addressed for rescue operations:

- The assessment of relative safety of personnel operating around collapsed or compromised structures is, at best, difficult. This assessment must be maintained continually throughout rescue operations. Safety and hazard identification issues must be addressed in the briefings conducted prior to any operations. Personnel hazards and mitigation should receive top priority in the briefings.
- Emergency signaling and evacuation procedures must be understood and immediately recognized, not only by task force personnel, but by all others (heavy-equipment operators, military personnel, local utility, and emergency workers, etc.) assisting in the operations. Effective emergency signaling and evacuation procedures are essential for the safe operation of all personnel operating at the disaster site. These procedures must be clear and universally understood by all task force personnel and others involved in the operations. Air horns or other appropriate hailing devices should be used to sound the appropriate signals:
  - Cease Operation/All Quiet                      one long blast (3 seconds)
  - Evacuate the Area                                  three short blasts (1-second each)
  - Resume Operations                                one long blast and one short blast

- Personnel rest and rehabilitation (R&R) is fundamental to the safe, effective, and sustained operation of the task force. Task force deployment and personnel work cycles must be determined, enforced, and continually reassessed by the task force managers, as previously discussed. In addition, it is incumbent on all personnel to understand, and maintain a constant awareness of, the need for water, food, and rest. Team managers and rescue squad officers must evaluate the need of their personnel, integrate these requirements into the ongoing operations, and ensure that all personnel comply accordingly. The rotation of personnel out of ongoing operations to address these issues should be handled on a scheduled basis and not at their own discretion. Fluid and food intake, as well as rest periods and sleep cycles, are vital to the safety and effectiveness of all personnel.
- Team managers and rescue squad officers must also maintain an awareness of and monitor personnel for the mental stresses involved in disaster operations--critical incident stress. Medical team managers and specialists are directly tasked with assessing this effect in all task force personnel during mission operations. Critical Incident Stress Management (CISM) or defusing intervention may be required.
- Task force managers must maintain a constant awareness of the detrimental effects of fatigue on the effectiveness and capabilities of all task force personnel. Taking into account mobilization, travel, and setup activities, personnel may be operating at reduced efficiency (possibly 70 to 50 percent or less) quite early in the mission. Also, a single-rescue operation can easily span 8 to 10 hours or more. In addition to the physical fatigue, it is equally important to understand that mental acuity is affected: Decision making abilities are slower and making decisions is more difficult.
- Rescue officers and personnel should request or offer advice and reassessment of each other's concerns. Team and/or squad "pep talks" (regrouping) may be required during prolonged operations to redefine responsibilities and ensure that the squad's focus is maintained on the plan of action, management structure, and safety considerations.
- Hygienic considerations must not be overlooked during mission operations. This includes not only the personal hygiene of all task force members, but exposure to and/or contact with victim body fluids, inhalation or ingestion of dusts and contaminated atmospheres, water, etc., and minor injuries. Medical team managers and specialists must be prepared to address these issues, including cleansing and treatment. All task force personnel must ensure that they maintain a ready change of clothing and that they adhere to the proper use of all personal protective equipment (PPE) and clothing.
- Task force managers must understand all procedures related to the treatment and/or transport of task force personnel sustaining injuries during rescue operations.

## **MEDICAL**

The medical function provides for initial care of victims rescued from collapsed structures. Rapid intervention for those trapped in the collapse is critical to their survival. Special medical techniques may be required for the victims, such as crush syndrome treatment.

Paramedics and emergency medical technicians (EMTs) trained in structural collapse rescue may need to enter the rescue zone to provide early care for trapped victims. They must also be available to provide treatment for rescue personnel.

A medical sizeup is important in developing the response plan. Factors include

- number, location, and condition of survivors;
- short-term versus long-term survival potential;
- hazards and environmental conditions; and
- on-scene medical and hospital capability and availability.

For deceased victims, response is required by law enforcement, coroner, or medical examiner.

### **Medical Operations**

Structural collapse situations produce rescue problems not routinely encountered by EMS personnel. Furthermore, prior to and during the actual rescue, trapped victims require special medical management of their injuries and illnesses.

Crush injury and crush syndrome, along with other problems, are common in trapped victims of collapsed structures.

Postextrication medical deterioration and death occur from potentially treatable issues associated with crush injury and crush syndrome. These injuries are a primary reason to provide the victim with prompt and continued care even before extricating him or her from the collapsed structure.

The goal is to rescue the patient, who returns to full preinjury level of function, and to have all the rescuers return home safely.

Through proper training and discipline, we can accomplish our goal. We must learn to recognize early the medical problems that exist in collapse and to be aggressive with our treatment. Whether it be as a result of trench collapse or structural collapse, crush syndrome, without early recognition and aggressive treatment, is the cause for patient deterioration.

Most important, however, we must have discipline to maintain safety at all times. Do not be in a hurry. Do a thorough sizeup, recognize the hazards, and maintain safety throughout the rescue.

## Definitions

### Direct Mechanical Crush

- mechanical disruption of tissue secondary to severe force; and
- immediate cellular effect/injury.

### Crush Injury

- muscle cell disruption due to compression;
- time/pressure relationship; and
- understanding of the cellular mechanism of injury controversial.

### Compartments Syndrome

- crush injury caused by swelling of tissue inside confining fibrous sheath of muscle's compartments; and
- causes further destruction of intracompartmental muscle and nerves.

### Crush Syndrome

- The **systemic** manifestation caused by crushed muscle tissue.
- Occurs when crushed muscle is released from compression.
- Muscle tissue extremely vulnerable to sustained pressure.
- Compression may be caused by debris or by the patient's own body weight, especially if lying on a hard surface.
- Timeframe until crush injury depends upon the amount of pressure and patient factors:
  - As short as 1 hour if compression is severe.
  - Four to six hours more common period for significant crush to occur.
  - Amount of tissue required to cause crush syndrome variable.
  - Usually lower extremities, buttocks, or entire upper extremity/pectoral area.

## **EXTRICATION (MOST DANGEROUS FOR RESCUE AND MEDICAL REASONS)**

In most cases, extrication is a lengthy process. Many decisions have to be made. In making these decisions, teamwork is the greatest tool for success. The following are some aspects to evaluate to help make a successful rescue.

### **Rescue Aspects**

- Debris unstable.

The debris can be extremely unstable, making for a dangerous working area. Always be aware of footing. Make clear and safe work areas.

- Equipment activity dangers.

With many tools and equipment in use, maintaining safety is paramount. Remember: Always evaluate the end result before cutting or lifting.

- Hazmat factors.

Determine what, if any, types of hazardous materials such as escaping gases, chemicals, etc., might be in the vicinity of the rescue.

- Utilities.

Utilities must be shut off and associated hazards mitigated (ruptured water, gas, sewer, and electrical lines).

### **Medical Sizeup**

- Time of entrapment.
- Estimated amount of weight. Estimate the amount of weight that the victim is being compressed under.
- Estimated time of release. Take into consideration all factors; the tendency is to fall short.

### **Medical Aspects**

- Incomplete assessment.

Depending upon the entrapment, it can be extremely difficult to assess a victim. Remember the basics--if the patient is talking, there is a lot of information to gather. If only a limb is accessible, check the pulse, skin signs, capillary refill, neurologic signs, hydration/dehydration, etc.

- Entrapment/release causes rapid changes in physiology.

Remember, when a limb is released, crush syndrome begins to set in. The released limb, in time, can become extremely painful. Continue to monitor the patient.

- Dust.

Keep the dust to a minimum. Dust problems can occur with the victim very easily. Treat it early with oxygen mask or dust mask. Rescuers can also succumb to long-term respiratory problems. A simple dust mask is an essential piece of protective equipment.

## **DISASTER VICTIMS AND TIME**

### **The Phases of the Golden Day**

- First 3 hours: most live victims rescued.
- Four to 6 hours: most common period for significant crush to occur.
- Twelve to 24 hours: airway, hypovolemia, hypothermia, dehydration.
- Survival declines. Remember, treat the victim before you extricate.

### **Phases of Trauma Death**

- First phase (rapid death).

Rapid death occurs mostly for one of two reasons: severe crush or asphyxiation.

- Second phase (hours after injury).

Some of the problems within hours of entrapment are dust, impaction, and hypovolemia.

- Third phase (late death).

There are usually two reasons for late death: infection and organ failure. The victim stands a better chance of survival from these two problems after early recognition and aggressive treatment. Infection in the field can be treated by early recognition and care of injuries. Organ failure is seen with crush syndrome. Be aggressive and treat early.

## **DISASTER INJURY PATTERNS**

Below are injuries most commonly found in confined space entrapments:

- lacerations;
- contusions;
- fractures;
- multisystem trauma;
- crush injury;
- respiratory injury;
- cardiac problems;
- hypo/hyperthermia;
- psychological factors;
- hypovolemia and dehydration;
- compartment syndrome; and
- crush syndrome.

## **STAGES OF MEDICAL CARE**

### **Initial Access**

- ABCs--this is always first consideration.
- Protect airway--don't forget about the dust problem. Treatment: oxygen mask, dust mask.
- Bleeding control--stop the bleeding and remember infection.
- Psychological support--this is a very important aspect that is sometimes overlooked. Remember, the victim is depending on you to get him/her out. The victim will experience feelings of fear and doom. Act professionally and continually reassure the victim.
- Assess for crush injury--consider time of entrapment, estimate amount of weight, estimated time of release. All of these factors, along with patient findings, are to be assessed.
- If crush potential is identified:
  - Basic Life Support (BLS)--you can give water by mouth.
  - Advanced Life Support (ALS)--establish IV access.
  - ALS--undertake fluid replacement prior to lifting compression.
  - ALS--consider prealkalizing with bicarbonate.

- ALS--use cardiac monitor--run a baseline strip.

## **Secondary Access**

- Immobilization.

When possible, don't forget the collar and spinal immobilization. Also, fractures must be splinted and stabilized.

- Hypo/Hyperthermic.

This can depend on weather conditions, but don't be fooled. Victims in confined spaces, especially for long periods of time, can become either hyperthermic or hypothermic.

## **Long-Term Care**

Victims of confined space may be in your care for hours. One important thing to remember is to take care of your own. It's a good idea to work in shifts when involved in long extrications.

## **MEDICAL PROBLEMS (IN INDIVIDUAL VICTIMS)**

### **Crush Syndrome**

- Caused by compression of limb(s) or body part.
- Membranes of injured cells break down and rupture.
- Cellular contents become available to circulation when crushing pressure is released.

### **Myoglobin**

- Myoglobin is an oxygen-carrying element within muscle tissues.
- Ruptured muscle cells release myoglobin.
- Myoglobin blocks working elements of kidney.
- Myoglobin causes reddish-brown urine in high concentration.



## **Lactic Acid**

Lactic acid is a byproduct of anaerobic metabolism. This is caused by the lack of blood flow due to entrapment. The buildup of lactic acid will cause myocardial irritability and vascular system depression.

## **Recognizing Crushed Limbs**

- Area initially may appear normal.
- Pulses initially may seem normal.
- Neuro may be positive or negative.
- Crushed extremity may be painless.
- Hypesthesia or anesthesia may be present.

## **Postrelease**

- Agitation.
- Continued hypesthesia/anesthesia or severe pain in crushed extremity.
- Muscle function decreased/paralysis.
- Progressively marked swelling of the area.
- Systemic problems.

## **Crush Injury Diagnosis**

- High index of suspicion.
- Identifying potential crush mechanism.
- Looking for subtle signs and symptoms.
- Urinary myoglobin postrelease.

## **Dust Inhalation**

This is the leading cause of death in concrete construction following trauma. Remember, this is also a major hazard for the rescuers. There is a high incidence of respiratory infection unless proper steps are taken (e.g., dust mask, proper ventilation).

## **Carbon Monoxide Inhalation**

This is mostly caused by the operation of gas-powered tools in confined spaces.

## **Secondarily Induced Trauma**

There is a high incidence of secondary injury to the victim caused by the rescuer.

- Walking on debris--Be careful where and how you walk.
- Pulling victim out--Remember, ensure that all limbs are free before you extricate (be patient).
- Location of the patient--Before you begin extrication, try to determine exactly how the patient is situated.

## **PROVIDING CARE IN HIGH-RISK CONDITIONS**

### **Confined-Space Operations**

It is important to determine the location of your safe area. Always leave yourself an out.

- Communication. It is extremely hard to communicate in a confined space. Use all of your options: radio, setting up a relay system, the use of runners, etc.
- Teamwork (the biggest key to success). There's always a different approach to solving a problem. Evaluate all ideas prior to deciding on a course of action.
- Extended operations. Don't forget care for the rescuers. Relieve one another on a continuing basis during an extended operation.
- Environmental extremes.
  - Dehydration--continually hydrate yourself.
  - Hypo/Hyperthermia--rescuers are not immune.

## CONFINED SPACE PATIENT MOVEMENT

- Priorities in movement: if multiple limbs are trapped, determine which to release first. Remember crush syndrome.
- Victim packaging:
  - Kendrick Extrication Device,
  - sled,
  - lashing, and
  - improvisation.

It is important to know your equipment and how it works. Practice with what you have and be prepared to improvise.

Historically, patients that have been entombed within a collapsed structure have died quickly following extrication. Victim survival can be enhanced dramatically by early recognition of medical needs and by providing medical care as soon as the victim is reached and then throughout the entire rescue process.

## Technical Specialists

These people may be needed if the incident is complex. These people support incident operations. A variety of specialists may be needed. The determination depends on the situation and need for expertise in a given area.

Examples of technical specialists that could be used at a structural collapse incident include

- **Structural Specialists:** These are structural engineers who can evaluate structural conditions and recommend safe access and structural mitigation to minimize risks (they work with rescue team).
- **Hazardous Materials Specialists:** They monitor environmental conditions and implement defensive measures to protect victim and rescuer (they work with search-and-rescue team).
- **Heavy Equipment and Rigging Specialists:** These specialists have expertise in the use of heavy equipment and can interact, advise, and coordinate between heavy-equipment operators and rescue personnel (they work with rescue team).
- **Weather Specialists:** They monitor weather conditions onsite and in region, and provide forecasts during incident operations.
- **Canine Specialists:** They have expertise in the use and care of various types of search dogs and provide recommendations on the use of dogs at an incident.

- **Equipment Specialists:** These specialists may be used to provide recommendations on the use of, or may operate, unique or specialized tools for rescue operations.

## **Safety**

Safety must be the top priority and everyone's job. Safety concerns at a collapsed structure worksite include

- hazard identification and risk analysis;
- incorporating safety into the IAP;
- monitoring operations for safety;
- providing appropriate protection;
- monitoring radio communications;
- enforcing personnel accountability;
- enforcing personnel rotation and rehabilitation;
- monitoring personnel for fatigue and stress; and
- investigating and documenting injuries.

## **Personnel Safety in Rescue Operations**

Safety of rescue personnel is the first priority within all search-and-rescue operations. Members involved must be constantly aware of the numerous factors that must be evaluated and reevaluated throughout ongoing operations.

- Assess the scene.  
  
Building construction, six sides; evaluate for access, egress, structural stability, terrain, and debris, etc.
- Assess hazards.  
  
Utilities, flammable liquids, water, flooding, plumbing and sewer, electrical, etc. (Electricity may be reenergized by department of water and power at any time.)
- Assess changing conditions.  
  
Aftershocks, landslides, weather conditions, flooding, structural shifting, winds, etc.
- Conduct preplanning.  
  
Operations must be preplanned and personnel trained, qualified, and team-oriented.  
  
Risks taken by rescuers must be calculated and the possible outcomes must be in favor of the rescuers.

Rescuers must operate in a safe manner at all times; think before acting.

- Deal with fatigue.

Recognize signs of fatigue, mental and physical, both for you and for other team members.

- Watch out for rescuer safety.

Never lay short! Safety lines in rope rescue, shoring--frequently and properly; do not go in too deep without a quick means of egress or a safe zone.

- Preposition rescue equipment, in event of a rescuer needing rescue.

***SAFE OPERATIONS AFFORD A GREATER  
NUMBER OF SUCCESSFUL RESCUES***

## **Activity 5.1**

### **Incident Objectives**

#### **Purpose**

To conduct sizeup of the incident and develop incident objectives.

#### **Directions**

1. You will stay in the same teams and use the same scenario from Activity 4.1, the apartment house collapse.
2. Your team should write incident objectives using responses from initial assessment made in Activity 4.1.
3. Each group should transfer the information to an easel pad.
4. A spokesperson from each team will present the list of objectives. The initial resource assignment is three engines, two trucks, and one battalion chief.



## Activity 5.2

### Developing Objectives, Strategies, Tactics, and Rescue Requirements

#### Purpose

To address operational concerns critical to the development of an IAP.

#### Directions

1. You will complete this activity as a member of the same group used in Activity 5.1.
2. Your group will use the same breakout area used during the last activity.
3. This activity will **build on** the scenario given to you in Activity 5.1. The groups in this activity will be accomplishing activity tasks; your group should respond from the perspective of the IC.
4. Your instructor will go over additional scenario details as used in Activities 4.1 and 5.1.
5. Once relocated in your breakout area, your group will do the following:
  - a. Elect a group spokesperson.
  - b. Divide your group's easel pad paper into two columns.
    - In the column on the left, build a list of initial incident objectives. (Objectives are to be in response to the problem/situation--e.g., search first, second, and third floors.)
    - In the column on the right, list **how** each objective will be implemented (what resources will be used).
  - c. Build a separate list of specialized equipment needs.
  - d. Develop an ICS organization chart (based on incident complexity and resource availability).
6. At the conclusion of the allotted time, the instructor will reconvene the class.
7. Each spokesperson will have 5 minutes to report the group's answers to the entire class.
8. The instructor will assist and clarify key points.

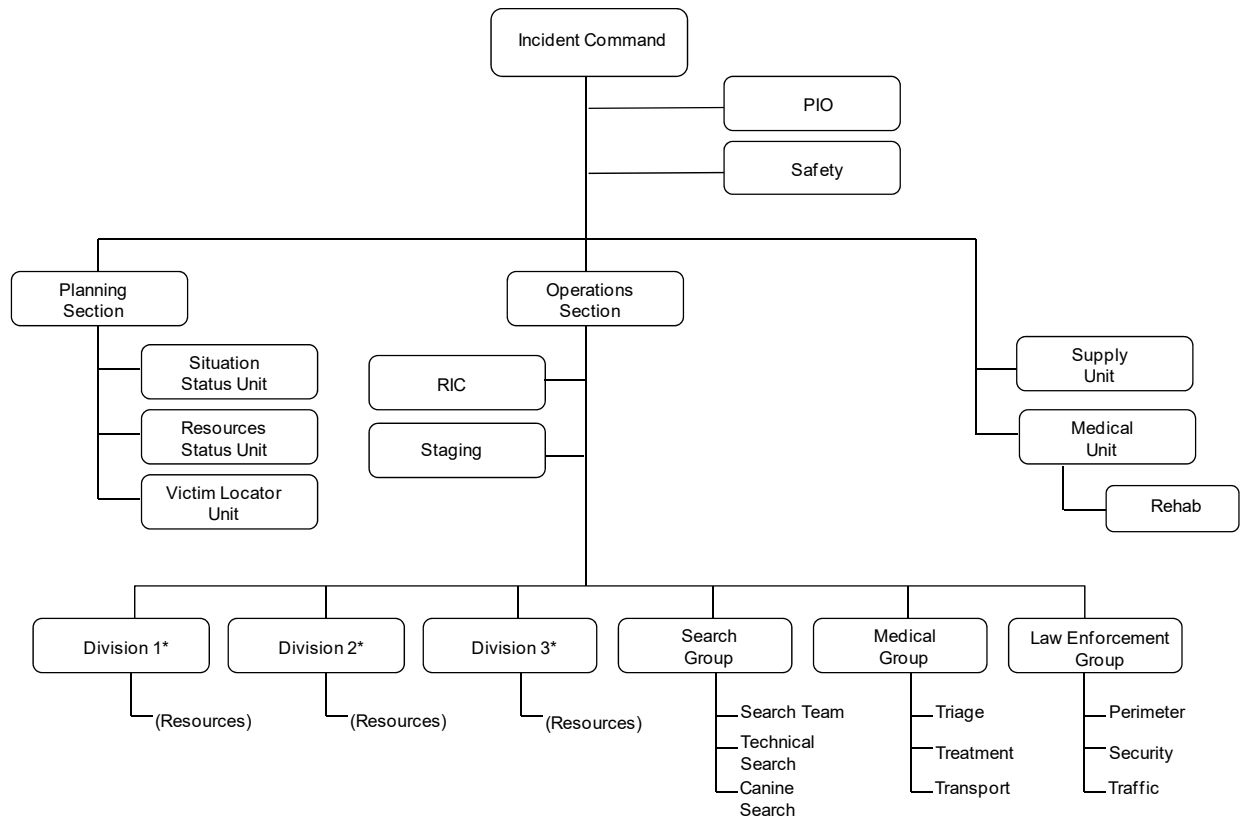


### **Additional Scenario Information**

- Resources assigned: three engines, two trucks, and one battalion chief. Maximum resources available for exercise (first 2 hours of response): eight engines, four trucks, one heavy rescue, four ambulances (two Advanced Life Support (ALS) and two Basic Life Support (BLS)), three battalion chiefs with aides, one police sergeant, six police units, and one police search dog.
- An estimated 40 units on first floor are heavily damaged under a pancake collapse.
- Many victims are trapped on the first floor and require extrication (estimated 80 to 100 people).
- Many victims are trapped and injured on the second and third floors (estimated 150 to 200 people).
- There have been two large aftershocks, causing additional collapse.
- Some cars in the garage are leaking gasoline.
- Weather reports the temperature rising to 95 °F (35 °C) today.
- Additional resources will be delayed due to widespread damage.
- Floor construction is lightweight concrete over plywood.
- There are a large crowd and news media at the scene.
- Staffing levels:
  - three per engine,
  - four per truck,
  - four per heavy rescue,
  - two per ambulance, and
  - two per police unit.

Activity 5.2 (cont'd)

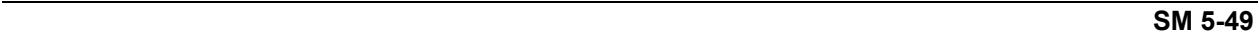
Possible ICS Organizational Chart



\* Note: Could be Division A, B, C, D, etc.



## Building Floor Plan





# NOTE-TAKING GUIDE



NOTE-TAKING GUIDE

Slide 5-1

**Unit 5:  
Response Functions**

Slide 5-1

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Slide 5-2

**Terminal Objective**

The students will be able to describe unique operational considerations for a structural collapse incident.

Slide 5-2

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Slide 5-3

**Enabling Objective**

The students will identify primary functions used during structural collapse operations.

Slide 5-3

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Slide 5-4

**Introduction**

The Incident Commander (IC) must be able to:

- Analyze an incident accurately
- Develop appropriate objectives, strategies, and resource requirements

Slide 5-4

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Slide 5-5

**Response Functions**

Command and coordination involves

- Obtaining incident information
- Analyzing intelligence
- Developing and selecting objectives and strategies
- Prioritizing objectives:
  - Life
  - Property
  - Utilities
  - Environment
  - Situation

Slide 5-5

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Slide 5-6

**Incident Objectives**

- Objectives are brief action statements of what needs to done.
- Objectives should be specific, measurable, action-oriented, reasonable, and have a time element involved.

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Slide 5-7

**Activity 5.1**  
**Incident Objectives**

Slide 5-7

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Slide 5-8

**Response Functions (cont'd)**

Command and coordination involves (cont'd)

- Setting objectives and developing strategies
- Determining resource requirements.
- Tasking resources
- Identifying logistic requirements
- Developing Incident Command System (ICS) organization

Slide 5-8

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Slide 5-9

**Response Functions (cont'd)**

- Preparing and implementing an Incident Action Plan (IAP)
- Deploying resources
- Evaluating progress toward objectives
- Revising plan (as needed to accomplish objectives)

Slide 5-9

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Slide 5-10

### **Search**

- **Locate victims.**
- **Use technical search equipment or dogs (as needed).**
- **Take a systematic approach (which enables the IC and rescue teams to increase efficiency and reduce injury).**

Slide 5-10

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Slide 5-11

### **Rescue**

- **Safety of rescue operations**
- **Compromised areas**
- **Structural stabilization**
- **Access**

Slide 5-11

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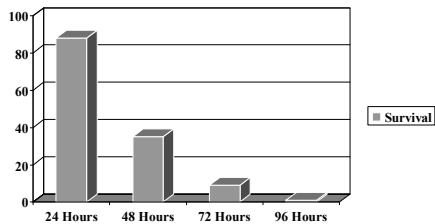
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Slide 5-12

### **The "Golden Day" of Survival**

**Over 80 percent of victims are rescued within the first 24 hours.**



Slide 5-12

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Slide 5-13

### **Prioritizing Rescues**

Factors include

- Victim viability and longevity
- Degree of difficulty and duration of rescue
- Rescue outcome potential (multiple victims versus single)
- Safety of rescuers and victims

Slide 5-13

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Slide 5-14

### **Structural Collapse Rescue**

Five phases:

- Phase I--Survey area for victims
- Phase II--Rescue surface victims
- Phase III--Explore voids and remove survivors
- Phase IV--Remove selected debris
- Phase V--Remove general debris

Slide 5-14

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Slide 5-15

### **Rescue Operations**

Coordination needs to be made with specialists such as:

- Structural-collapse engineers
- Heavy-equipment operators
- Hazardous Materials Specialists
- Medical personnel

Slide 5-15

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Slide 5-16

### Medical Functions

- Provision of initial care to victims
- Entry of paramedics and emergency medical technicians (EMTs) to the rescue zone (to provide care)
- Provision of treatment for responders

Slide 5-16

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Slide 5-17

### Medical Sizeup

- Medical assessment factors include
  - Number, location, and condition of survivors.
  - Short-term versus long-term survival potential.
  - Hazards and environmental conditions.
  - Onscene medical and hospital capability and availability.
- Deceased require response by law enforcement, coroner, or medical examiner.

Slide 5-17

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Slide 5-18

### Medical Care

Victim survival can be improved by recognizing medical needs early and by providing medical care as soon as the victim is reached and continuously throughout the rescue process.

Slide 5-18

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Slide 5-19

### **Technical Specialists**

Technical Specialists are needed for:

- Unique situations
- Complex situations

Slide 5-19

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Slide 5-20

### **Safety**

Safety involves

- Identifying hazards and analyzing risks
- Incorporating safety in the IAP
- Monitoring operations (for safety issues)
- Providing appropriate protection
- Monitoring radio communications

Slide 5-20

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Slide 5-21

### **Safety (cont'd)**

- Enforcing personnel accountability
- Enforcing personnel rotation and rehabilitation
- Monitoring personnel for fatigue and stress
- Investigating and documenting injuries

Slide 5-21

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Slide 5-22

**Activity 5.2**  
**Developing Objectives**  
**Strategies, Tactics, and**  
**Rescue Requirements**

Slide 5-22

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Slide 5-68

### Summary

The IC must

- Analyze a collapsed structure incident accurately
- Develop appropriate objectives, strategies, and resource requirements to locate and rescue the injured and trapped effectively

Slide 5-68

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Slide 5-69

### Summary (cont'd)

The Command and coordination function:

- Obtains initial incident information
- Analyzes intelligence
- Develops strategies
- Identifies/Develops objectives
- Prioritizes objectives
- Determines resource requirements

Slide 5-69

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Slide 5-70

**Summary (cont'd)**

- Tasks resources
- Identifies logistics requirements
- Develops an ICS organization
- Prepares and implements the IAP
- Deploys resources
- Evaluates operations and progress toward achieving objectives
- Revises plan as needed to accomplish objectives

Slide 5-70

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Slide 5-71

**Summary (cont'd)**

**Response functions for standard collapse consist of:**

- Command and coordination
- Search
- Rescue
- Medical
- Technical Specialists
- Safety

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# **UNIT 6: STRUCTURAL COLLAPSE: OPERATIONAL PHASES**

## **TERMINAL OBJECTIVE**

*The students will be able to describe all operational phases associated with a structural collapse incident.*

## **ENABLING OBJECTIVES**

*The students will:*

1. *Define five operational phases.*
  2. *Describe the conditions that trigger transition of operational phases.*
  3. *Demonstrate an ability to develop an appropriate Incident Command System (ICS) organization to command and control a structural collapse incident.*
  4. *Identify, request, and apply specialized Urban Search and Rescue (US&R) resources.*
  5. *Explain the application of critical scene management issues and factors in the appropriate operational phase.*
-





## **INTRODUCTION**

A major structural collapse incident can progress through a total of five phases. **This first phase--the initial response--**involves initiation of the following actions by the first Incident Commander (IC):

- establishing Command;
- conducting a sizeup;
- developing an action plan; and
- deploying resources.

The incident can then proceed to the second phase--the **reinforced response**. **This type of response** requires a larger incident organization and additional support requirements.

The third phase is referred to as an **extended response** (involving 24-hour operations). This phase requires:

- a detailed Incident Action Plan (IAP);
- augmented organization; and
- an effective coordination system.

These three response phases are followed by **demobilization** (Phase IV) and **return to a state of readiness** (Phase V).

## **FIVE OPERATIONAL PHASES--OVERVIEW**

The response and buildup to a major incident, as well as downgrading, closure, and return to normal activities, can be defined by the following five phases:

- **Phase I:** Initial response;
- **Phase II:** Expanded (reinforced) response;
- **Phase III:** Extended response (24-hour operation);
- **Phase IV:** Demobilization; and
- **Phase V:** Return to a state of readiness.

## **PHASE I: INITIAL RESPONSE**

This initial phase involves the following six actions.

1. **Establishing Command.** This is accomplished by:
  - announcing Command;
  - assuming all Command and General Staff responsibilities;

- providing a brief radio report (i.e., location, type of structure, and situation) to the dispatch center (responding companies should be monitoring this report); and
- establishing an Incident Command Post (ICP).

2. **Performing a sizeup.** Sizeup involves the following tasks:

- surveying the site;
- determining the type of problem;
- identifying hazards;
- assessing conditions;
- determining victim locations and viability;
- identifying exposures; and
- assessing potential for escalation.

The Structural Collapse Operational Checklist (provided in Appendix L) is a good administrative tool to use during sizeup.

3. **Developing an IAP.** Essential steps in action planning are

- understanding the situation;
- establishing objectives and strategy;
- developing tactical direction and assignments;
- preparing the plan (consider using Incident Command System (ICS) Form 201);
- implementing the plan; and
- evaluating the plan.

An IAP helps establish priorities, points out hazards, and reviews items such as risk/benefit and safety.

The initial IAP may involve the use of a form that begins the written plan. The ICS Form 201 (Incident Briefing) may be used for this purpose and as a briefing form for the Transfer of Command to another officer. This form includes a map or diagram of the area involved, incident objectives and actions taken, and the incident organization and resource summary.

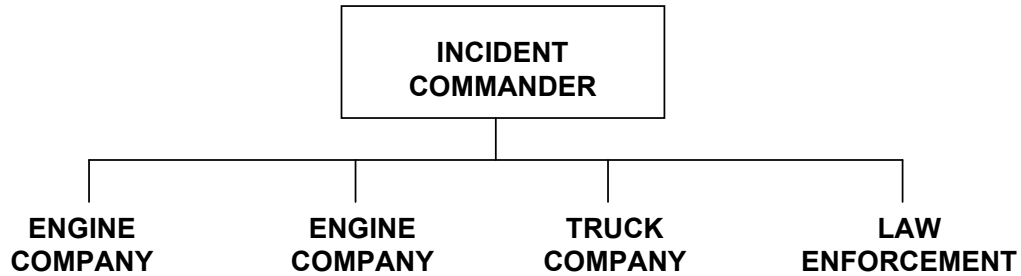
4. **Requesting resources.**

Once the IAP is developed and objectives have been established, request the resources required to achieve the objectives. For example, to achieve the objective "search the first and second floor for victims," request an engine company and a truck company.

5. **Deploying and organizing resources.**

- The initial response may include from one to five single resources.

- The ICS organization at an initial response level consists of the IC and the single resources assigned to specific tasks (as illustrated in Figure 6-1).



**Figure 6-1**  
**Initial Response**

- The IC must deploy appropriate resources to the incident in order to accomplish priority objectives.
- Scene management must be initiated early by isolating the area and establishing zones, e.g., "the collapse zone."

**6. Evaluating response.**

- Evaluation requires accurate information and good communication (status/progress reports).
- You can determine resource effectiveness from the evaluation by comparing progress to objectives.

**PHASE II: EXPANDED (REINFORCED) RESPONSE**

An expanded (or reinforced) response is initiated when the IC determines that initial resources are insufficient to handle the incident. The expanded (reinforced) response involves

- **A sizeup.** It must
  - Be continuous,
  - Anticipate the need for an extended operation, and
  - Document information.
- **Transfer of Command.** Transfer of Command may take place during the expanded response phase.

During Transfer of Command, the officer assuming Command communicates with the officer being relieved and a briefing takes place (ICS Form 201 should be used). This briefing covers

- incident conditions;
- IAP;
- progress toward completing objectives;
- safety considerations;
- resource assignments;
- need for additional resources; and
- critical issues.

The officer being relieved is then reassigned and a change in Command is communicated.

- **Evaluating the current situation.** The following factors should be considered during the evaluation of incident operations.
  - What has happened?
  - What progress has been made?
  - How good is the current plan?
  - What is the incident growth potential?
  - What are the present and future resource and organizational capability?
- **Developing a risk management plan.**
  - Hazards need to be assessed and controlled or avoided, and
  - Risks need to be managed.
- **Establishing scene control.** Establishing scene control includes accomplishment of the following:
  - zone establishment,
  - bystander evacuation,
  - controlling perimeters,
  - establishment of site security,
  - establishment of incident facilities,
  - suitable ICP,
  - Staging Area(s), and
  - triage and treatment area.
- **Developing an IAP.** A more detailed IAP may be needed for an expanded response.
  - Clear statement of objectives and strategies,
  - Basis for measuring work effectiveness and progress, and
  - Basis for providing accountability.

Essential plan elements are

- statement of specific, measurable, action-oriented, reasonable, and timely (SMART) objectives;
- description/review of incident organization;
- tactics and resource assignments; and
- support plans (traffic, medical, communications, safety, demobilization, and others as needed).

IAP objectives should always be

- specific;
- measurable;
- action-oriented;
- reasonable; and
- timely.

Dynamic incidents change, so the plan needs to be flexible and broad enough to accommodate change.

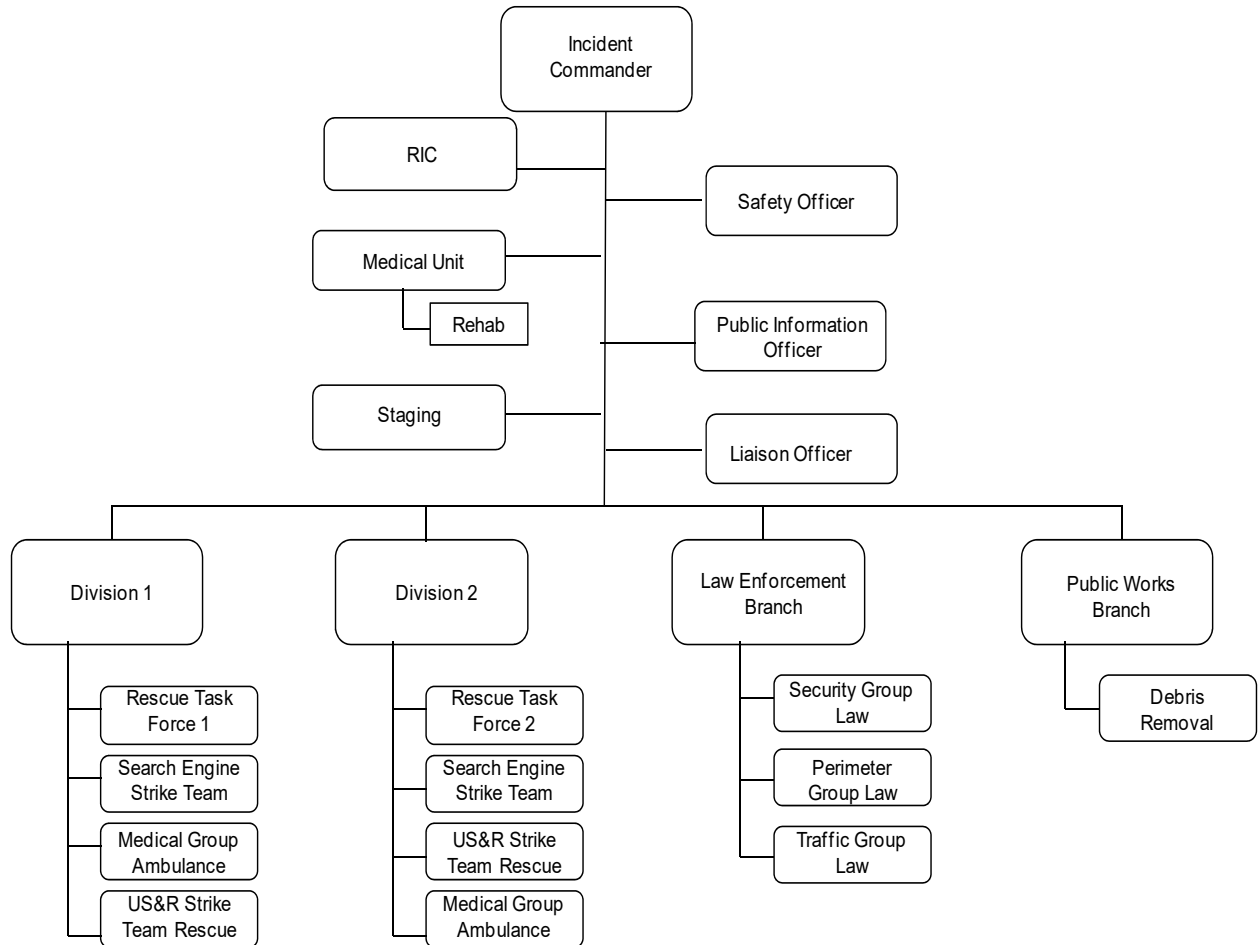
Written IAPs should be used when:

- two or more jurisdictions are involved;
- operational periods are required;
- many organizational elements exist;
- IAP is required by an agency; and
- the incident expands beyond the initial response phase.

An example of a multidivision IAP has been included in the Appendix of your SM.

- **Expanding the ICS organization.** The ICS organization may be expanded based on the size and magnitude of the incident. Expansion is based on resource and management needs.

Figure 6-2 illustrates an ICS for expanded response, showing how the system builds, and subsequent resource assignments.



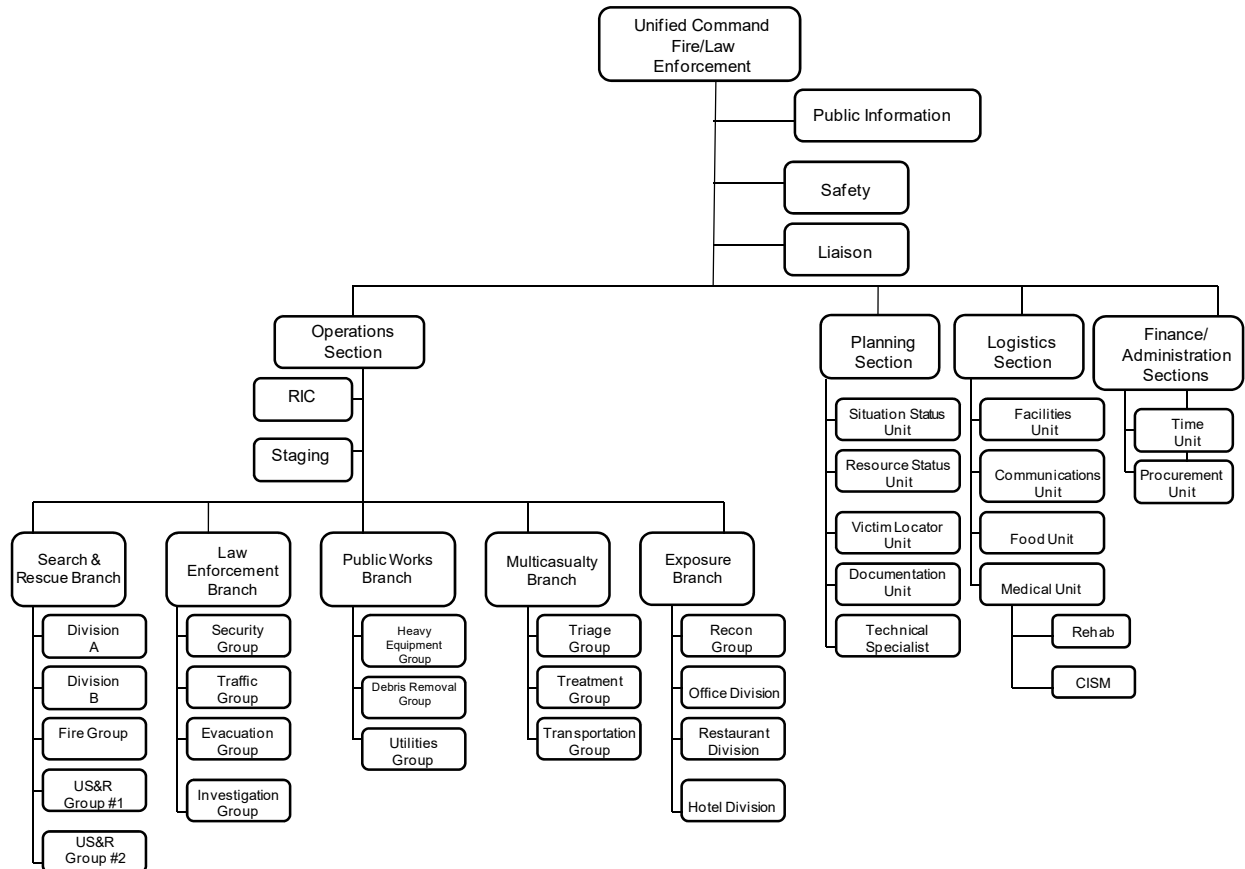
**Figure 6-2  
Expanded Response**

In the example of an expanded response organization displayed in Figure 6-2, the initial response organization has been reinforced with the arrival of additional fire department resources and resources from law enforcement and public works agencies:

- The IC has assigned a Safety Officer to ensure personnel safety and a Public Information Officer (PIO) to work with media.
- A Staging Area has been established to check in arriving resources.
- Public Works has been assigned to debris removal.
- The incident has been divided into two divisions to manage resources better:
  - Original engine and truck companies are grouped together to form one task force.

- Second-to-arrive local engine and truck companies are grouped together to form another task force.

Figure 6-3 illustrates a multigroup/division response that manages span of control with General Staff, geographic, and functional assignments.



**Figure 6-3**  
**Multigroup/Division Response**

In the example of the multigroup/divisional response organization displayed in Figure 6-3, the IC has formed a Unified Command (UC) with the senior law enforcement official onscene because of the major involvement of both agencies.

The IC has added

- A Liaison Officer to coordinate assisting agencies.
- An Operations Section Chief (OSC) to manage the tactical operations of a combination of divisions and groups.



- A Planning Section Chief (PSC) to manage situation and resource status units (SITSTAT and RESTAT) and the Technical Specialists assigned.
- A Law Group to handle security, traffic control, and evacuation.
- A Medical Group to handle triage, treatment, patient transportation, and the deceased.
- Several operational elements formed in the Operations Section to improve span of control, management, and coordination:
  - a Structural Specialist to assist in Division B,
  - a Hand Crew Strike Team to remove debris in Division B, and
  - one State/National Urban Search and Rescue (US&R) Task Force assigned to Division A.
- A US&R Technical Specialist has been assigned to the Planning Section.
- Supply Unit and a Ground Support Unit established; Logistics Section Chief (LSC) not yet required.

### **PHASE III: EXTENDED RESPONSE (24-HOUR OPERATION)**

An extended response involves operations over a 24-hour period.

#### **Detailed Incident Action Plan**

A detailed IAP is necessary for incidents with an extended response involving operational periods and multiple agency or multijurisdiction involvement. This document is developed by the Planning Section. The plan documents the activities developed for a given period of time and, when all attachments are included, specifies

- specific detailed objectives;
- strategies (to meet those objectives);
- resource assignments;
- incident organization;
- required maps and information specific to the incident;
- a communications plan;
- a medical plan;
- a safety plan; and
- a traffic plan.

The IAP serves as a guide so that operational effectiveness can be evaluated based on the objectives set for the operational period. As work progresses, priorities change based upon a continual evaluation of the incident. Flexibility is important and contingency plans are a necessity in dynamic and hazardous incidents.

## **Operational Periods**

Operational periods are planned time periods needed to achieve objectives. Rapidly changing incidents require shorter operational periods.

The planning process for an operational period involves these 10 steps:

1. State incident objectives.
2. Give situation and resource briefing.
3. State primary and alternative strategies to meet objectives.
4. Designate branch, division, and group boundaries and functions.
5. Describe tactical operations and tactics.
6. Make tactical resource assignments.
7. Specify reporting locations and additional facilities needed.
8. Identify the resources, support, and overhead personnel requirements.
9. Consider additional support resources needed because of communications, traffic, safety, medical, etc.
10. Finalize, approve, and implement the plan.

## **Logistical Support**

Logistic support is critical to maintaining extended rescue operations. An incident of major complexity and size involving possibly hundreds of response personnel requires a Logistics Section capable of meeting the needs of the incident through demobilization.

For example, long-term operations may require

- lighting for night operations or reduced visibility;
- large food and water supplies;
- major equipment repair and supply functions;
- special equipment acquisitions;
- other support functions specific to a structural collapse incident (e.g., heavy equipment, structural stabilization resources, security measures including barricades, fencing);
- coordinated communications and technical equipment;
- expanded facilities; and
- additional facilities for rehab and Critical Incident Stress Management (CISM), air operations, etc.

## **Incident Facilities**

Incident facilities such as the ICP and a Staging Area should be set up early in the best possible locations. Incident facilities used for an extended operation at a major structural collapse may require

- several Staging Areas for specific resources (as an example, one for heavy equipment);
- a large base to accommodate personnel through rehab, rest, and feeding cycles, and vehicle and specialized equipment fueling and repair functions;
- a supply and equipment distribution system;
- an ICP with the capability to sustain a large Command Staff and effective communications;
- a larger triage and treatment area;
- a morgue;
- a decontamination area;
- a secure evidence recovery and holding area; and
- multiple medical units/responder rehabilitation.

## **Integrated Communications**

Communications at the incident are managed through the use of a common communications plan and an incident-based communications center established solely for the use of tactical and support resources assigned to the incident. All communications between organizational elements at an incident should be in plain English, "clear text." No codes should be used, and all communications should be confined only to essential messages. The Communications Unit is responsible for all communications planning at the incident. This includes incident-established radio networks, onsite telephone, public address, and offincident telephone/microwave/radio systems.

### **Radio Networks**

Radio networks for large incidents are normally organized as follows:

- **Command Net.** This net should link together Incident Command, key staff members, section chiefs, and division and group supervisors.
- **Tactical Nets.** There may be several tactical nets. They may be established around agencies, departments, geographical areas, or even specific functions. The determination of how nets are set up should be a joint Planning/Operations function. The Communications Unit Leader develops the plan.
- **Support Net or Logistics Net.** A support net is established primarily to handle status changing for resources as well as for support requests and certain other nontactical or Command functions.

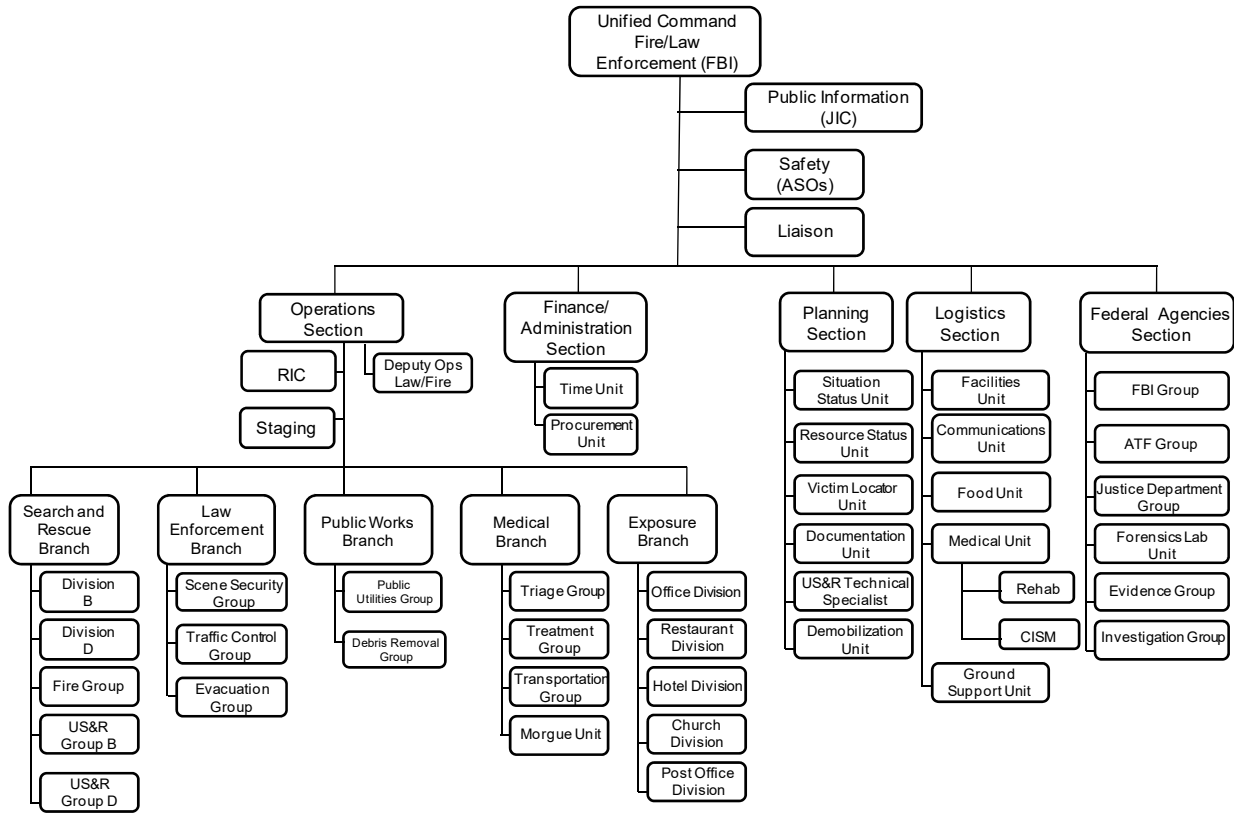
- **Ground-to-Air Net.** A ground-to-air tactical net may be designated, or regular tactical nets may be used to coordinate ground-to-air traffic.
- **Air-to-Air Net.** Air-to-air nets are normally predesignated and assigned for use at the incident.

### **Extended Incident Command System Organization**

The extended ICS organization for a structural collapse incident of major magnitude may require

- an incident organization involving resources from many agencies; and
- a UC organization.

Figure 6-4 shows a multibranch organization chart illustrating how a major ICS may be organized for an extended operation.



**Figure 6-4**  
**Multibranch Response**

The multibranch response organization displayed in Figure 6-4 involves an extended ICS organization with UC.

The IC has assigned an LSC and a Finance/Administration Section Chief.

The Operations Section has established five branches with similar functions to coordinate and manage resources more effectively and to maintain an effective span of control.

The Planning, Logistics, and Finance/Administration Sections have several units operational to support the large amount of resources at the incident.

### Incident Command System/Emergency Operations Center Interface

An Incident Command/Emergency Operations Center (EOC) interface is needed to provide for effective information flow and coordination between the incident site and the EOC.

- An EOC is a location from which centralized emergency management can be carried out. The activation and level of activity and staffing depend on the size and complexity of the emergency.
- The local government EOC is activated to support field response agencies when needed and to facilitate overall coordination of multiagency operations.
- Local government EOCs serve as the central point for coordination inside and outside the jurisdiction. These EOCs gather and disseminate information and assist in supporting field operational Incident Commands.
- Field-level (ICP) coordination with the local EOC may go through the dispatch center to the EOC--or, in some jurisdictions, the ICS Field Command may have direct communications with or receive policy direction from the EOC. Coordination may be with other agencies, organizations, the media, and citizens inside and outside of the local government involved.
- EOCs may be managed using the five primary ICS functions of Command, Operations, Planning, Logistics, and Finance/Administration.
- The IC would most likely interact with the EOC OSC. In some jurisdictions, local policy may provide for direct IC-to-EOC management interaction. This may occur when there is a large single incident that has major impact on the community.
- It may be useful in some situations (if approved by the IC) to have direct coordination between incident sections and their counterpart EOC section (i.e., Planning Section to Planning Section).
- Under UC, the EOC interactions are similar to those described above, but using their department's contact in the Operations Section.

## **PHASE IV: DEMOBILIZATION**

Demobilization planning must start early. Each section of the ICS must participate by providing information needed to ensure a smooth demobilization process. Important information elements include

- resource information (location, operation, designation, type, and kind);
- agency agreements (use conditions or time used requirements);
- physical condition of personnel (determines whether personnel need rehabilitation before rerelease);
- transportation (requirements for transportation from incident);
- costs (cost accounting for time and use of resources); and
- priority (or critical) needs (priority of need for resource to return to home agency or another incident).

Development of the demobilization plan must begin early in the incident. The plan should include

- Information on the demobilization procedure;
- Responsibilities for incident personnel:
  - Planning Section provides information on resources,
  - Liaison Officer knows terms of agreements on release,
  - Safety Officer considers physical condition of personnel and transportation,
  - Logistics Section handles transportation, communications, and maintenance,
  - Operations Section knows continuing needs for tactical resources, and
  - Finance Section processes claims, time records, and costs.
- Release procedures (may include rehabilitation for personnel, maintenance, and resupply). Agency dispatch centers give priorities for the timely release of resources. Release priorities should include priority factors as follows:
  - Type of resource,
  - Critical need elsewhere,
  - Cost, and
  - Travel distance.
- Personnel should be debriefed or defused as necessary in accordance with the incident CISM plan; and
- All forms and records should be collected.

## **PHASE V: RETURN TO A STATE OF READINESS**

Emergency response organizations must be able to return to a state of readiness as soon as possible to provide protection to the community they serve.

- Rehabilitating personnel should be the first step. Provisions should be in place for a CISM program (so members may receive debriefings, defusing, or follow-up care).
- Repair or replace equipment.
- Forward records, reports, and other information for processing.
- Complete an after-action analysis as necessary depending on size, complexity, or other circumstances such as agency requirements. The purpose of this analysis is to evaluate the response and to capture lessons learned for application to future operations.
- Adjust operating procedures to incorporate lessons learned.

## Activity 6.1

### Implementing Initial Incident Command System Organization

#### Purpose

To demonstrate the ability to design and implement an initial IAP and associated ICS organization.

#### Directions

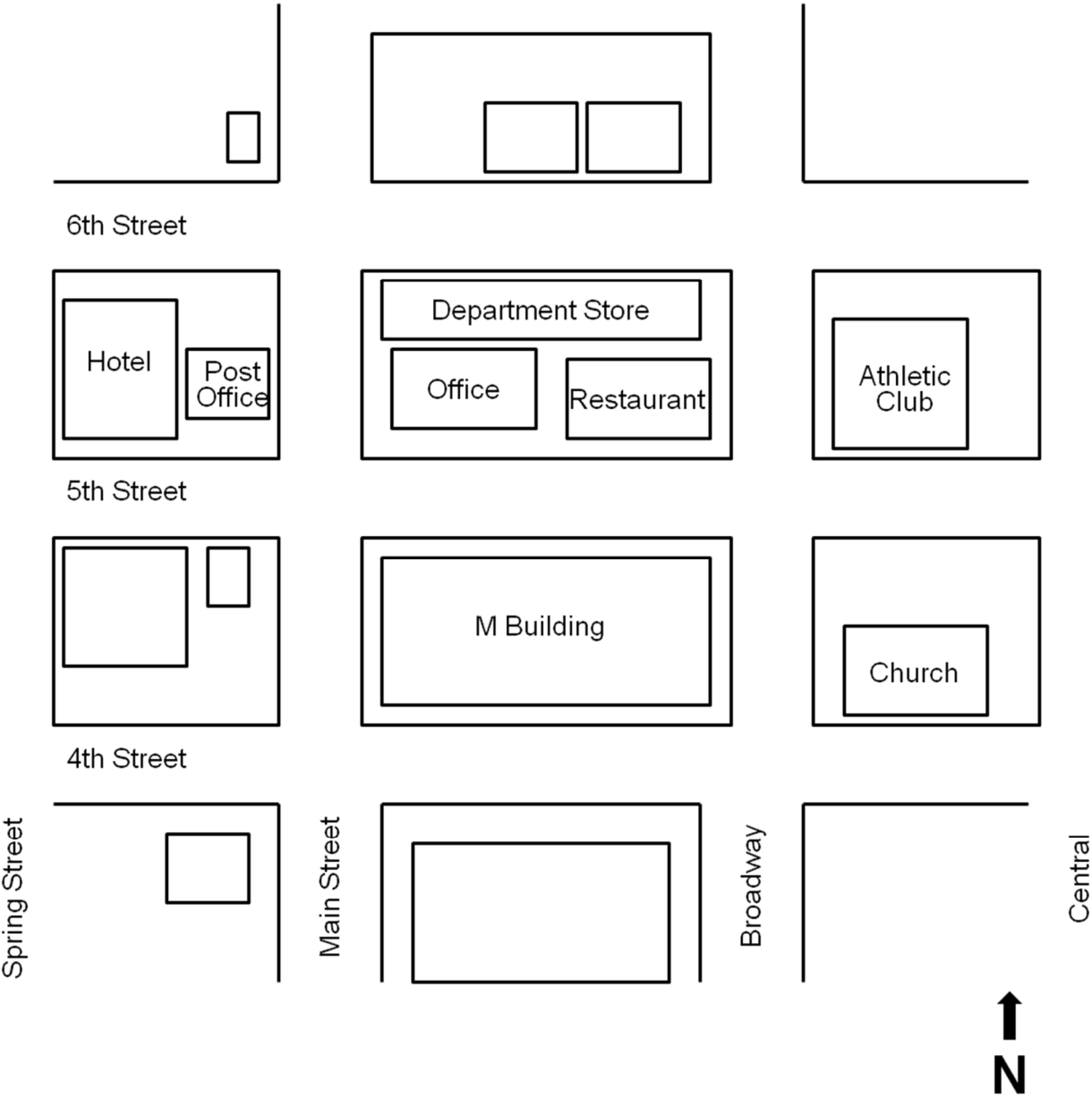
1. You will perform this activity in the same workgroup used for the last activity.
2. Your group will use the same breakout area.
3. While accomplishing this activity, your group should respond from the perspective of being the **first-arriving officer on scene**.
4. Turn to the incident map provided. Your instructor will present you with details on this new scenario.
5. Once you have heard the scenario details and relocated in your breakout area, your group will:
  - a. Elect a group spokesperson and recorder.
  - b. Perform an incident sizeup.
  - c. Develop an initial IAP using the ICS Form 201 provided. (Note: When building your organization chart, show only what is **on scene**.)
6. At the conclusion of the allotted time, the instructor will reconvene the class.
7. Your spokesperson will have 5 minutes to present **one** element of your assignment. (Your instructor will inform the group spokesperson of which presentation element immediately prior to the presentation.)
8. Your instructor will comment on each presentation, summarize group findings, and respond to questions.
9. Keep your completed ICS Form 201, as it will be needed in future activities.





Activity 6.1 (cont'd)

Incident Area Map





**Activity 6.1 (cont'd)****Instructions for completing the Incident Briefing (ICS Form 201)**

Item Number 1	Incident Name	Enter name of incident.
Item Number 2	Date Prepared	Enter date (month/day/year).
Item Number 3	Time Prepared	Enter time prepared (24-hour clock).
Item Number 4	Map Sketch	Show: perimeter, control lines, structures resource assignments, incident facilities, and other special information on a sketched map (or attached to a map).
Item Number 5	Prepared by	Enter the name and position of the person completing the form.
Item Number 6	Summary of Current Objectives and Actions	Enter the strategy and tactics used on the incident and note any specific problem areas.
Item Number 7	Current Organization	Enter on the organization chart the names of the organization individuals assigned to each position. Modify chart as necessary.
Item Number 8	Resource Summary	Enter the following information about the summary resources ordered: <ul style="list-style-type: none"><li>- Resources ordered (enter the number and type of resources ordered)</li><li>- Resource identification (enter the agency identifier: S/T, TF, kind and type)</li><li>- ETA/On-scene (enter the estimated time of arrival. Place the arrival time or a checkmark in the "on-scene" column upon arrival)</li><li>- Location/Assignment (enter the assigned location of the resource and/or the actual assignment)</li></ul>

*NOTE: additional pages may be added to this form if needed.*



Activity 6.1

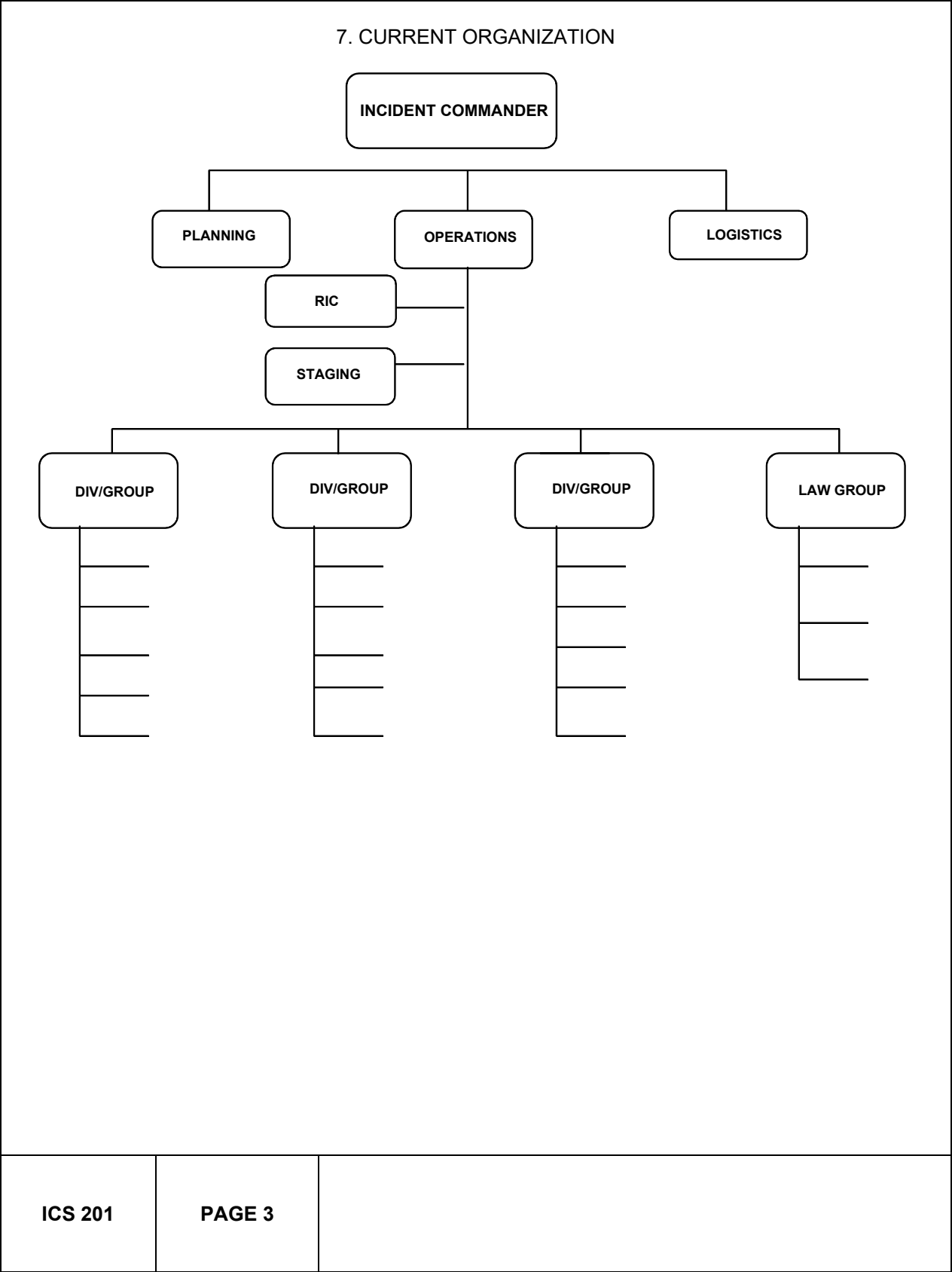
ICS Form 201

INCIDENT BRIEFING	1. Incident Name	2. Date Prepared	3. Time Prepared
4. Map Sketch			
ICS 201	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

6. SUMMARY OF CURRENT OBJECTIVES AND ACTIONS

CURRENT OBJECTIVES:

CURRENT ACTIONS:





## 8. RESOURCES SUMMARY

[illegible]

## Activity 6.2

### Implementing an Expanded Incident Command System Organization

#### Purpose

To demonstrate an ability to **expand** an Incident Command organization.

#### Directions

1. You will reassemble in the same groups that you were in for Activity 6.1.
2. Your group will use the same breakout area as last time.
3. This activity will **build on** the scenario presented to you in Activity 6.1.
4. The **difference in approach** between this activity and the last is that in this activity, while accomplishing activity tasks, your group is to respond from the perspective of the **IC**.
5. Turn to the incident map that your group used in Activity 6.1.
6. Your instructor will present the class with **additional** details on the scenario.
7. Once relocated in your breakout area, your group will do the following:
  - a. Elect a group spokesperson and recorder.
  - b. Return to the organization chart and objectives created in Activity 6.1 (ICS Form 201).
  - c. Based on the **additional** incident details provided, perform the following tasks. Record your findings on an easel pad.
8. When your time is up, the instructor will reconvene the class.
9. The instructor will then ask each group spokesperson to name one (or more) organization chart element(s) (and associated objective(s)).
10. Your instructor will summarize group findings and respond to questions.
11. Keep the organization charts and list of objectives created during this activity, as they will be used later in this course.



## **Activity 6.3**

### **Organizing Extended Operations**

#### **Purpose**

To understand and to be able to develop a fully expanded ICS organization.

#### **Directions**

1. The instructor will show additional slides and present additional scenario details that build from Activity 6.2.
2. You should remain in your same groups.

#### **Discussion**

The instructor will facilitate a class discussion on the following:

1. Operational objectives for the extended operation.
2. An expanded ICS organization chart.
3. Resource requirements necessary to meet operational objectives.
4. Incident facilities needed for the incident.



# NOTE-TAKING GUIDE



NOTE-TAKING GUIDE

Slide 6-1

**Unit 6:  
Structural Collapse:  
Operational Phases**

Slide 6-1

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Slide 6-2

**Terminal Objective**

The students will be able to describe all operational phases associated with a structural collapse incident.

Slide 6-2

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Slide 6-3

**Enabling Objectives**

The students will:

- Define five operational phases.
- Describe the conditions that trigger transition of operational phases.
- Demonstrate an ability to develop an appropriate Incident Command System (ICS) organization to command and control a structural collapse incident.

Slide 6-3

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Slide 6-4

### Enabling Objectives (cont'd)

- Identify, request, and apply specialized Urban Search and Rescue (US&R) resources.
- Explain the application of critical scene management issues and factors in the appropriate operational phase.

Slide 6-4

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Slide 6-5

### Operational Phases

Major structural collapse incidents move through five operational phases:

- Phase I: Initial response
- Phase II: Expanded response (reinforced)
- Phase III: Extended response (24-hour operation)
- Phase IV: Demobilization
- Phase V: Return to a state of readiness

Slide 6-5

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Slide 6-6

### Phase I: Initial Response

Slide 6-6

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Slide 6-7

### **Establishing Command**

Process includes

- **Announcing Command**
- **Assuming all Command and General Staff responsibilities**
- **Providing a brief radio report (location, type of structure, and situation)**
- **Establishing an Incident Command Post (ICP)**

Slide 6-7

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Slide 6-8

### **Conducting a Sizeup**

Assessment of:

- **Survey site**
- **Type of problem**
- **Hazards**
- **Conditions**
- **Victims**
- **Exposures**
- **Potential for escalation**

Slide 6-8

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Slide 6-9

### **Developing an Incident Action Plan**

Steps include

- **Understanding the situation**
- **Establishing objectives and strategy**
- **Developing tactical directions and assignments**
- **Preparing the plan (ICS Form 201)**
- **Implementing the plan**
- **Evaluating the plan**

Slide 6-9

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Slide 6-10

# Requesting Resources

Request for sufficient resources required to implement the Incident Action Plan (IAP).

Slide 6-10

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Slide 6-11

# Resource Deployment and Organization

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graph TD; IC[Incident Commander] --> E1[Engine 1]; IC --> E2[Engine 2]; IC --> T1[Truck 1]; IC --> LE[Law Enforcement]; E1 --> T1_1[Task]; E2 --> T2_1[Task]; T1 --> T3_1[Task];
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Slide 6-11

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Slide 6-12

# Resource Deployment and Organization (cont'd)

- Deploy resources to accomplish priority objectives
- Initiate scene management:
  - Isolate the area
  - Establish zones

Slide 6-12

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Slide 6-13

**Involves Evaluating Response**

- Requires accurate information and good communications (status/progress reports)
- Involves determining resource effectiveness in achieving objectives

Slide 6-13

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Slide 6-14

**Activity 6.1  
Implementing the Initial  
Incident Command  
System Organization**

Slide 6-14

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Slide 6-15

**Video:  
"Initial Response"**

Slide 6-15

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Slide 6-17



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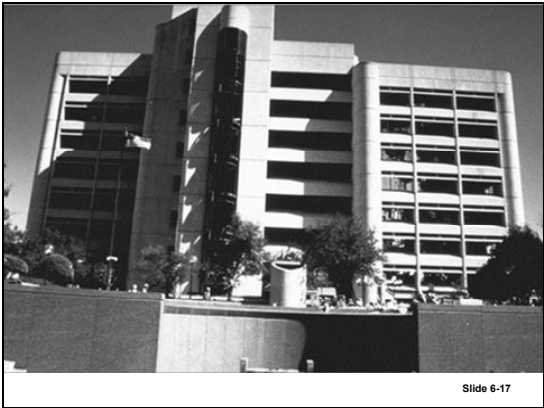
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Slide 6-18



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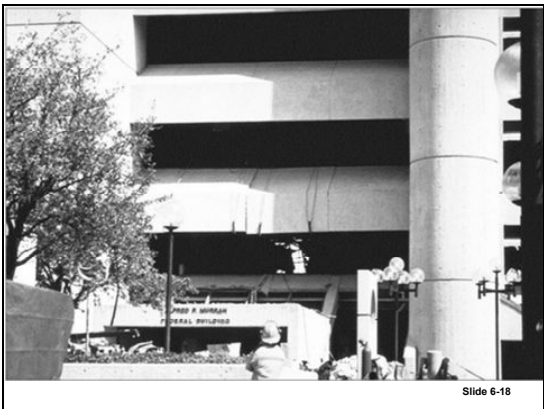
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Slide 6-19



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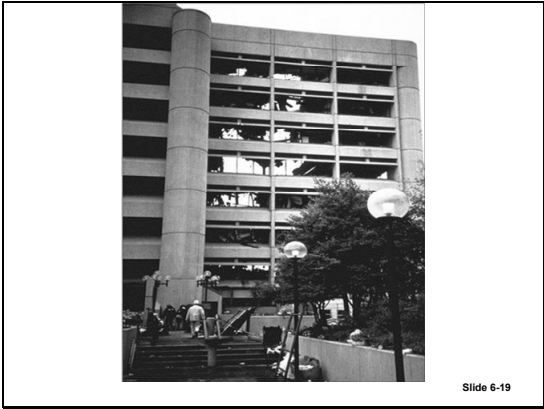
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Slide 6-20



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Slide 6-21



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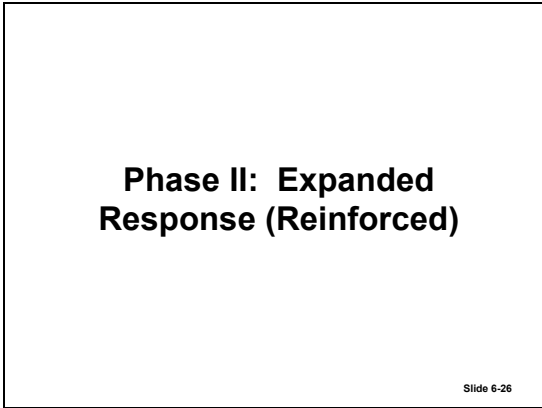
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Slide 6-27



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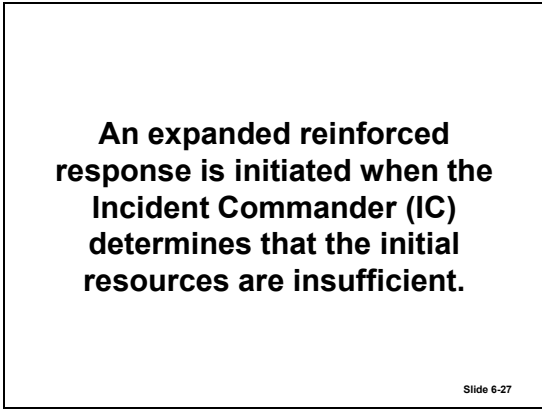
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Slide 6-28



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Slide 6-29

### Sizeup

This must

- Be continuous
- Anticipate the need for an extended operation
- Document information

Slide 6-28

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Slide 6-30

### Transfer of Command

- Communication with the officer being relieved
- A briefing (using ICS Form 201) that contains:
  - Incident conditions
  - IAP
  - Progress toward completing objectives
  - Safety considerations
  - Resource assignments
  - Need for additional resources
  - Critical issues

Slide 6-29

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Slide 6-31

### Transfer of Command (cont'd)

- Reassignment of the officer being relieved
- Communication of the change of Command

Slide 6-30

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Slide 6-32

### **Evaluation of Current Situation**

**Identify:**

- What happened
- Progress made
- Quality of current plan
- Incident growth potential
- Present (and future) resource and organizational capability

Slide 6-31

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Slide 6-33

### **Developing a Risk Management Plan**

- Hazards must be assessed.
- Hazards must be controlled (or avoided).
- Risk must be managed.

Slide 6-32

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Slide 6-34

### **Scene Control**

- Zone establishment
- Bystander evacuation
- Perimeter control
- Establishment of site security
- Establishment of incident facilities
  - Suitable ICP
  - Staging Area(s)
  - Triage and treatment areas

Slide 6-33

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Slide 6-35

**Developing/Expanding an Incident Action Plan**

The plan needs to provide

- Clear statement of objectives and strategies
- Basis for measuring work effectiveness
- Basis for measuring progress and providing for accountability

Slide 6-34

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Slide 6-36

**Developing/Expanding an Incident Action Plan (cont'd)**

Essential IAP elements include

- Statement of specific, measurable, action-oriented, reasonable, and timely (SMART) objectives
- Incident organization
- Tactics and resource requirements
- Support plans

Slide 6-35

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Slide 6-37

**Developing/Expanding an Incident Action Plan (cont'd)**

IAP objectives should be:

- Specific
- Measurable
- Action-oriented
- Reasonable
- Timely

Slide 6-36

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Slide 6-38

### Developing/Expanding an Incident Action Plan (cont'd)

- Written IAPs should be used when:
- Two or more jurisdictions are involved.
  - Operational periods are required.
  - Many organizational elements exist.
  - IAP is required by agencies involved.
  - The incident expands beyond the initial response phase.

Slide 6-37

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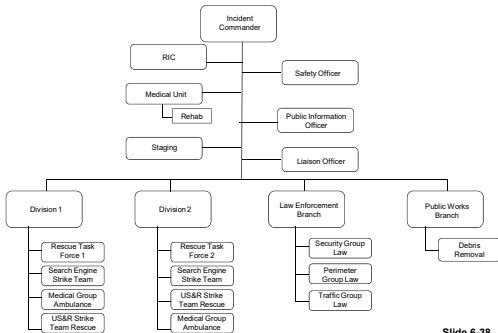
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Slide 6-39

### Expanded Response



Slide 6-38

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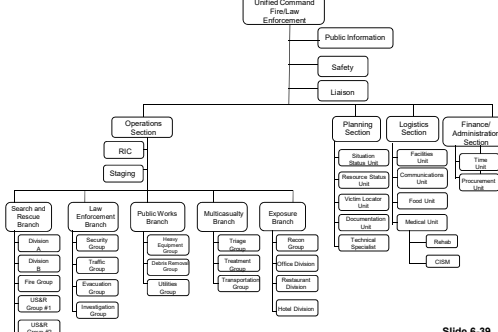
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Slide 6-40

### Multigroup/Division Response



Slide 6-39

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Slide 6-41

**Activity 6.2**  
**Implementing an Expanded**  
**Incident Command System**  
**Organization**

Slide 6-40

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Slide 6-42



Slide 6-41

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Slide 6-43



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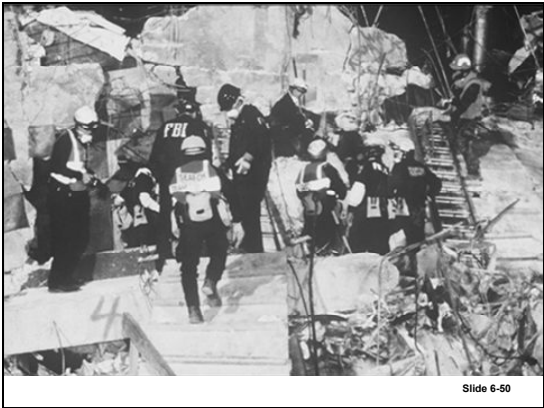
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Slide 6-51



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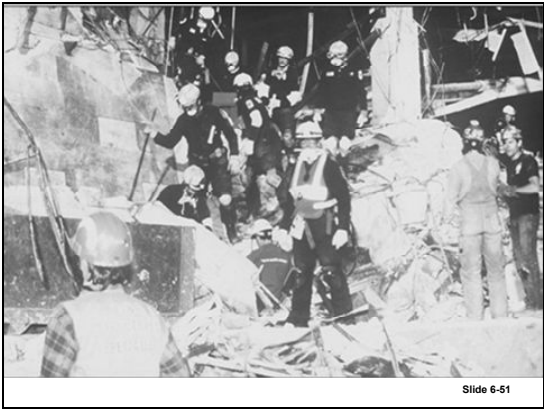
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Slide 6-52



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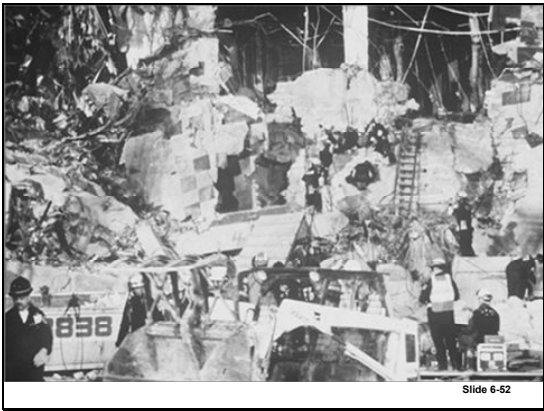
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Slide 6-53



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Slide 6-54



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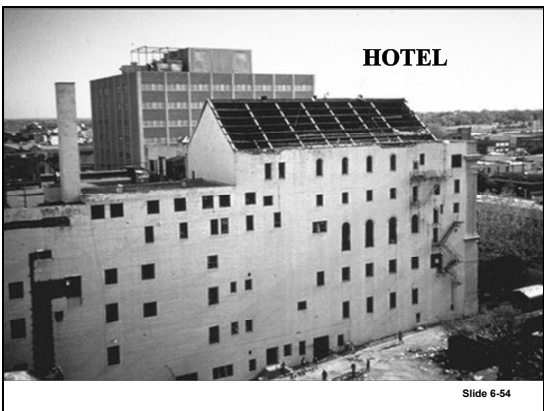
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Slide 6-55



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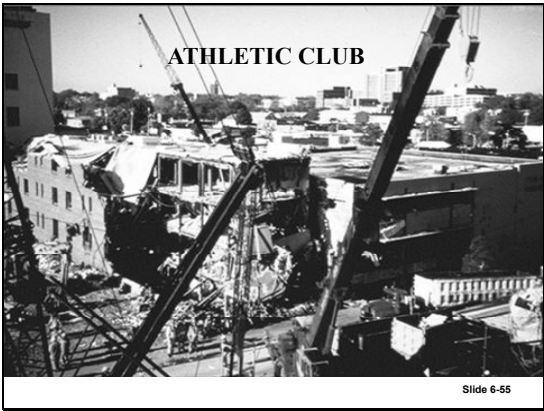
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Slide 6-56



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Slide 6-57



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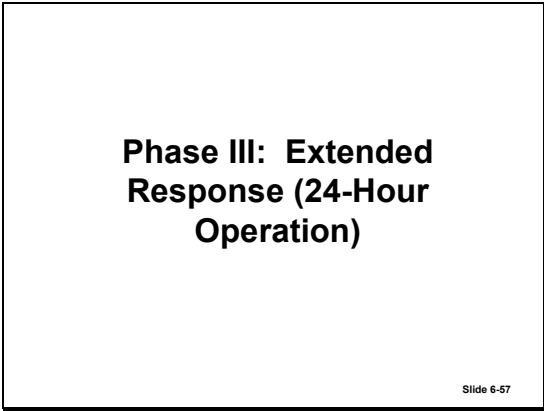
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Slide 6-58



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Slide 6-59

**Detailed Incident Action Plan**

- A detailed IAP is necessary for incidents with:
  - Extended response
  - Operational periods
  - Multiagency involvement
  - Multijurisdiction involvement
- Developed by the Planning Section for each operational period

Slide 6-58

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Slide 6-60

**Detailed Incident Action Plan  
(cont'd)**

- Essential elements include
  - Specific detailed objectives
  - Strategies to accomplish those objectives
  - Resource assignments
  - Incident organization
  - Maps
  - Plans for communications, medical, safety, and traffic

Slide 6-59

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Slide 6-61

**Detailed Incident Action Plan  
(cont'd)**

- Serves as a guide to evaluate operational effectiveness (based on objectives set for the operational period)
- Changes (as work progresses, priorities change)
- Is flexible (contingency plans are a necessity)

Slide 6-60

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Slide 6-62

**Operational Periods**

- Planned time periods (needed to achieve objectives)
- Require shorter operational periods (due to rapidly changing incidents)

Slide 6-61

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Slide 6-63

**Logistical Support**

Logistics support needs to change to meet long-term needs, such as:

- Lighting
- Large food/water supply
- Major equipment repair and supply function
- Special equipment acquisitions
- Other support functions (specific to a structural collapse incident)

Slide 6-62

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Slide 6-64

**Incident Facilities**

Those used may include

- Multiple Staging Areas
- Large base for personnel and equipment
- Supply and equipment distribution system
- Expanded ICP
- Larger triage and treatment areas
- Morgue
- Decontamination area
- Evidence recovery and holding areas
- Multiple Medical Units/Rehab

Slide 6-63

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Slide 6-65

### **Extended Incident Command System Organization**

A structural collapse incident of major magnitude may require an incident organization that involves resources from many agencies that work in a Unified Command (UC).

Slide 6-64

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Slide 6-66

### **Extended Incident Command System--Unified Command**

During a multibranch response:

- The IC assigns Logistics and Finance/Administration Chiefs.
- Operations has established five branches.
- Planning, Logistics, and Finance/Administration have several operational units.

Slide 6-65

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Slide 6-67

### **Interface with Emergency Operations Center**

- Emergency Operations Center (EOC) is activated to support response agencies and coordinate multiagency operations.
- Local government EOCs are the central point for coordination inside and outside the jurisdiction.
- Field-level coordination may go through dispatch.

Slide 6-66

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Slide 6-68

**Interface with Emergency Operations Center (cont'd)**

- This may be managed using the five primary ICS functions.
- The IC normally interfaces with the EOC Operations Section.
- Section Chiefs may interface directly with EOC Section Chiefs if approved by IC.

Slide 6-67

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Slide 6-69

**Activity 6.3  
Organizing Extended Operations**

Slide 6-68

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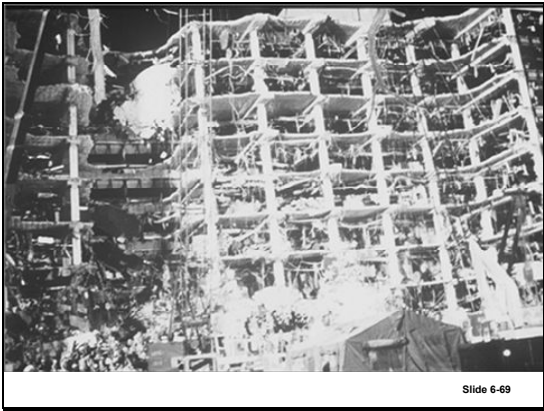
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Slide 6-70



Slide 6-69

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Slide 6-71



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Slide 6-73



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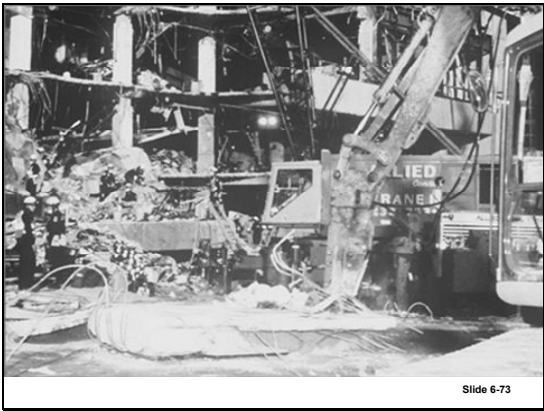
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Slide 6-74



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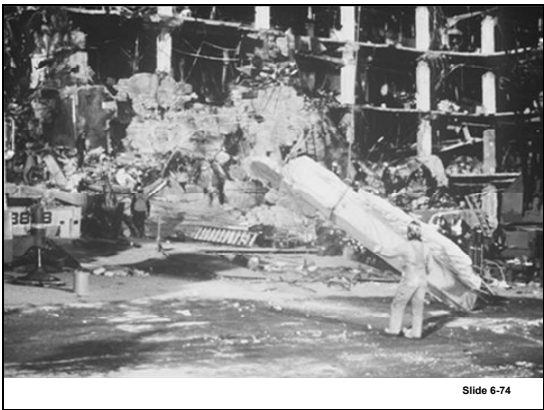
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Slide 6-75



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Slide 6-76



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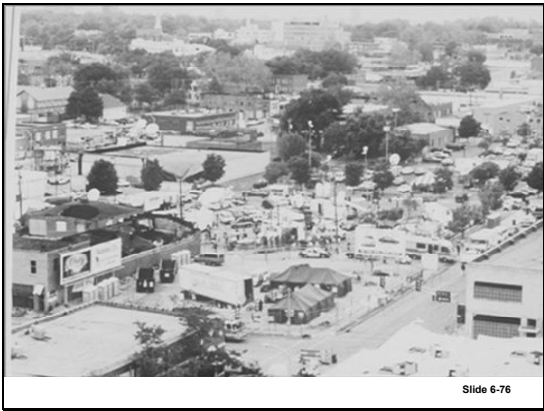
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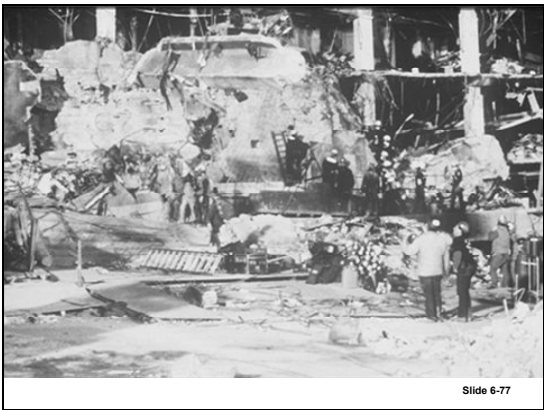
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Slide 6-78



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Slide 6-79



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Slide 6-80



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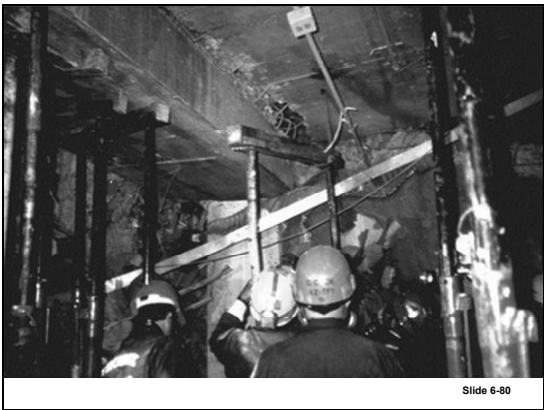
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Slide 6-81



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Slide 6-82



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Slide 6-87



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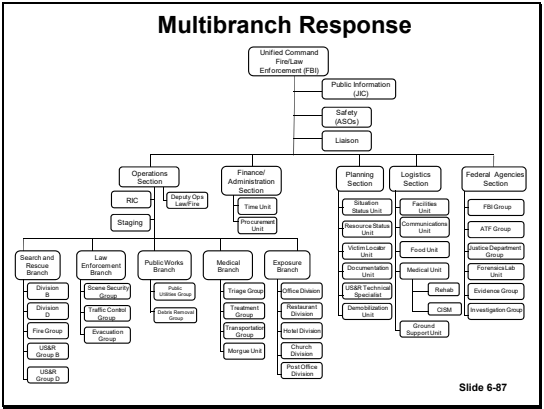
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Slide 6-88



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Slide 6-89

### Summary

Five operational phases of an incident

- Initial response
- Expanded response (reinforced)
- Extended response (24-hour operations)
- Demobilization
- Return to readiness

Slide 6-88

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Slide 6-90

### Summary (cont'd)

- Incident action planning is continuous and provides direction for all incident personnel.
- The ICS expands (or contracts) based on resource and management needs of the incident.
- Sizeup, safety, risk, management, scene control, response evaluation, and coordination are key functions of the IC.

Slide 6-89

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**U.S. DEPARTMENT OF HOMELAND SECURITY**

**UNITED STATES FIRE ADMINISTRATION**

**NATIONAL FIRE ACADEMY**

**FOREWORD**

The U.S. Fire Administration (USFA), an important component of the Department of Homeland Security (DHS) Preparedness Directorate, serves the leadership of this Nation as the DHS's fire protection and emergency response expert. The USFA is located at the National Emergency Training Center (NETC) in Emmitsburg, Maryland, and includes the National Fire Academy (NFA), National Fire Data Center (NFDC), and the National Preparedness Network (PREPnet). The USFA also provides oversight and management of the Noble Training Center in Anniston, Alabama. The mission of the USFA is to save lives and reduce economic losses due to fire and related emergencies through training, research, data collection and analysis, public education, and coordination with other Federal agencies and fire protection and emergency service personnel.

The USFA's National Fire Academy offers a diverse course delivery system, combining resident courses, off-campus deliveries in cooperation with State training organizations, weekend instruction, and online courses. The USFA maintains a blended learning approach to its course selections and course development. Resident courses are delivered at both the Emmitsburg campus and its Noble facility. Off-campus courses are delivered in cooperation with State and local fire training organizations to ensure this Nation's firefighters are prepared for the hazards they face.

*Incident Command System for Structural Collapse Incidents (ICSSCI)* is designed to provide fire command officers with an understanding of Command operations at structural collapse incidents.

## **ACKNOWLEDGMENTS**

The dedication, cooperation, and assistance of many professionals have made this course possible. The National Fire Academy wishes to thank the following people and organizations for their role in the revision of this course.

## **DEVELOPMENT GROUP**

Mr. Terry Clements, Asst. Fire Chief (Retired)  
Clearwater Fire Department  
Clearwater, FL  
Consultant

Mr. Robert Dubé, Chief  
Louisa County, VA  
Fire & EMS, Consultant

Mr. Robert J Bennett, Training Specialist  
National Fire Academy, Emmitsburg, MD

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